



Energy Audit Report
Bodoland University, Kokrajhar (BTR)
(Assam) 2021-22



ENERGY AUDIT REPORT



Bodoland University,
Kokrajhar (BTR), (Assam)
Year 2021-22

PREPARED BY

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(2021-22)



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ACKNOWLEDGEMENT

Empirical Exergy Private Limited (EEPL), Indore (M.P) takes this opportunity to appreciate & thank the management of **Bodoland University, Kokrajhar, Assam** for allowing us to conduct an energy audit for the university.

We are indeed touched by the helpful attitude and co-operation of all faculties and technical staff, who rendered their valuable assistance and co-operation during the course of study.




Rajesh Kumar Singadiya

(Director)


M.Tech (Energy Management), PhD (Research Scholar)
Accredited Energy Auditor [AEA-0284]
Certified Energy Auditor [CEA-7271]
(BEE, Ministry of Power, Govt. of India)
Empanelled Energy Auditor with MPUVN, Bhopal M.P.
Lead Auditor ISO50001:2011 [EnMS) from FICCI, Delhi
Certified Water Auditor (NPC, Govt of India)
Chartered Engineer [M-1699118], the Institution of Engineers (India)
Member of ISHRAE [58150]



Certificate of Accreditation

 **BUREAU OF ENERGY EFFICIENCY**

Examination Registration No.: **EA-7271**
Accreditation Registration No.: **AEA-284**



Certificate of Accreditation

This is to certify that Mr./Ms. **Shri. Rajesh Kumar Singadiya** having its trade/registered office at has been given accreditation as accredited energy auditor. The certificate shall be effective from **9th** day of **May, 2018**.


The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

Your name has been entered at AEA No. **284** in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this **5th** day of **October, 2018**


Secretary,
Bureau of Energy Efficiency
New Delhi



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Green Monitoring Committee.



OFFICE OF THE INTERNAL QUALITY ASSURANCE CELL
(IQAC)
BODOLAND UNIVERSITY
DEBARGAON, KOKRAJHAR, BTR, ASSAM-783370


Ref. BU/IQAC/2022/Letter/01

Dated 16/09/2022

OFFICE ORDER

As approved by the Honorable Vice-Chancellor dated 1/09/22, the Green Audit Committee, Bodoland University, is constituted with the following member's effect from the date of issue of the order till the further order.

S/N	Profile	Name
1.	Convener	Dr Hemen Sarma, Dept of Botany
2.	Members	Chairperson, Kokrajhar Municipal Corporation
3.		Prof. Haremba Bailung, Dept. of Physics
4.		Prof. Hilloljyoti Singha, Dept. of Zoology
5.		Prof. Sanjoy Basumatary, Dept of Chemistry
6.		Dr. Kushal Choudhury, Dept of Zoology
7.		Dr. Sanjib Barua, Dept of Botany
8.		Dr. Yutika Narzary, Dept of Botany
9.		Dr. Rebecca Daimary, Dept of Botany


(Prof. Sujit Deka)
Director
Director, IQAC
Bodoland University
Kokrajhar, 783370

File No. BU/IQAC/Essential/2022/01

Copy to –

1. P.S. to the Vice-Chancellor, Bodoland University for information
2. Members Concerned
3. Office File



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The Audit Team

The study team constituted of the following senior technical executives from **Empirical Exergy Private Limited**

- ✦ **Mr. Rajesh Kumar Singadiya** [Director & Accredited Energy Auditor AEA-0284]
- ✦ **Mr. Rakesh Pathak**, [Director & Electrical Expert]
- ✦ **Mr. Sachin Kumawat** [Sr. Project Engineer]
- ✦ **Mrs. Laxmi Raikwar Singadiya** [Chemical Engineer]
- ✦ **Mr. Ajay Nahra** [Sr. Accountant & admin]
- ✦ **Mr. Charchit Pathak** [Asst.Project Engineer]
- ✦ **Mr. Aakash Kumawat** [Junior Engineer]
- ✦ **Mr. Mohan Choudhary** [Sr. Electrician]



EXECUTIVE SUMMARY

ENERGY CONSERVATION INITIATIVE TAKEN OF THE UNIVERSITY

- ✚ University has installed 14 kWp Solar systems on Incubation center and New Girls hostel Building. Garneted energy is utilized in above university buildings . **Its Appreciable**

ENERGY AUDIT RECOMMENDATIONS

✚ **SOLAR SYSTEM**

- There is a good potential to installation of 90 KWp solar roof top grid connected system in the university. Expected annual solar unit generation @ 4 units per KWp is 1, 31,400 Unit. **Details calculation in chapter-04.**
- Existing system has required unit generation monitoring system. Recommended to install energy meter to monitoring unit generation.

✚ **LIGHTING SYSTEM**

- Replacement of “conventional T-12 (40 Watt)” tube light by energy efficient 18 Watt LED lighting was taken up phased manner. **Details calculation in chapter-04**
- Replacement of “conventional (18 Watt) CFL by energy efficient 9 Watt LED bulb **Details calculation in chapter-04**

✚ **CEILING FAN**

Replacement of “conventional ceiling fan (80 Watt)” by energy efficient star rated fan or BLDC based energy efficient fan (28 Watt) in “admin building, class rooms, laboratories and faculties cabin” have great potential for energy saving. **Details calculation in chapter-04**

✚ **IOT BASED ENERGY MONITORING SYSTEM AT MAIN FEEDER**

- Installation of “Cloud based (IoT based) energy monitoring system” including harmonic measurement (total voltage and current harmonic distortion %) on Transformer LT side for energy monitoring. Expected energy saving potential about 2 to 4%.
- Installation of energy meters between transformer and building panel with IoT system will monitor line losses of the system. It will give real time measurement of power factor and line losses from the cable.



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+ MOTION SENSOR.

- Installation of motion sensor in class room, faculties, washroom, toilets and non-working area in university.

+ TIMER CONTROLLED STREET LIGHTS

- Installation of “Timer control on street lighting” in university campus is recommended.

+ STAND ALONE SYSTEM ON STREET LIGHT.

- There are good potential to install solar stand-alone system for street light with 20 Watt LED lighting system.



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ENERGY CONSERVATION MEASURES FOR ELECTRICAL SYSTEM

Case Study	Section	Identification	Observation	Recommendation	Annual energy saving (kWh)	Annual cost saving (Rs.)	Investment (Rs.)	Simple payback Period (Year)
1	Solar System	Potential for solar project as per Net Metering policy	Power taken from grid	Install 90 kWp solar systems with new trasformer	1,31,400 kWh Generation annual	9,46,080/-	45,00,000/-	4.8 Year
2	Lighting System	1118 No. FTL tube light	Power consumption by T-12 (40 Watt)	Replacement of conventional (T-12) with (18 Watt) LED	49,192	3,54,182/-	2,34,780/-	8 Month
3	Lighting System	42 No CFL light	Power consumption by CFL (18 Watt)	Replacement of CFL by 09 Watt LED bulb	756	5,443/-	4,410/-	9.7 Month
4	Celling Fan	955 No conventional ceiling fan working with 80 Watt	Power consumption by existing ceiling fan (80 Watt)	Replacement of 80W conventional ceiling fan by 28W BLDC energy efficient ceiling fan	79,456	3,08,044/-	20,05,500/-	6.5 Year



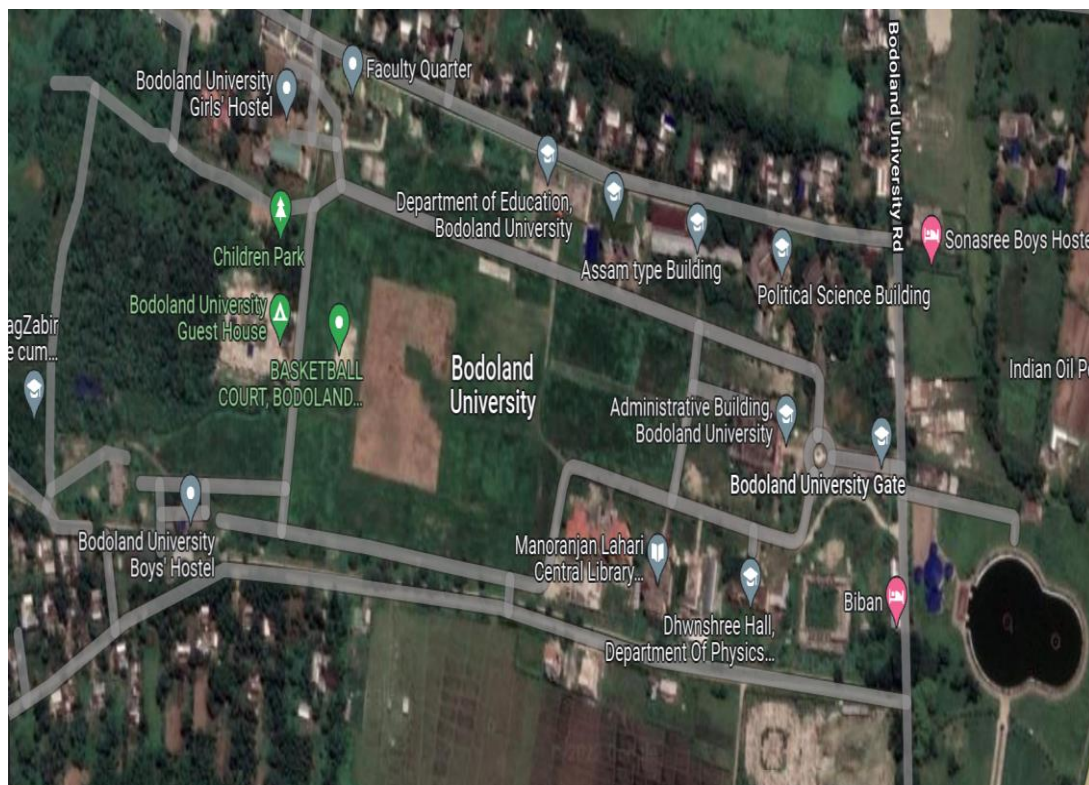
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CHAPTER-1 INTRODUCTION

1.1 About University

Bodoland University was established by Bodoland University Act 2009, passed in the Assam legislative Assembly. The present Bodoland University is an up-gradation of the Kokrajhar campus of Gauhati University to a full fledged state university as per the provision of the Act



Source: - Satellite image of Bodoland University



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VISION.

Bodoland University aspires to be a lead public university that can indoctrinate its student's moral values, scientific temper, socio-cultural, economic and political leadership qualities in order to meet the regional, national and global challenges.

MISSION.

1. To impart value based education leading to holistic sustainable development.
2. To conduct need based location-specific research and development of the highest quality with a wide range of interests.
3. Keeping clear focus on the advancement of technology, effort to be made to increase efficiency of existing technology, optimize the use of natural resources and preserve the environment.
4. To ensure access of all sections of the society for higher education keeping in view the prevailing socio-economic deprivations.
5. To inculcate woman empowerment potential through education.
6. To protect, preserve and promote ethics and cultural heritage pertinent to the location in particular and country in general for furtherance of national integrity.
7. To provide up-to-date, relevant and need-based knowledge.
8. To promote flexible, effective governance.
9. To create linkage with concerned centre of advancement/excellence in country /abroad.
10. To produce high-caliber students who are expected to play leading roles in their chosen careers ensuring effective and sustainable social actions. The University should be a breeding ground of new generation of human resource who would be job-creators and not job-seekers.



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1.2 About Campus

The Total build up area of the university in the given table. Total build-up area for all floors 57869 SQ.MT

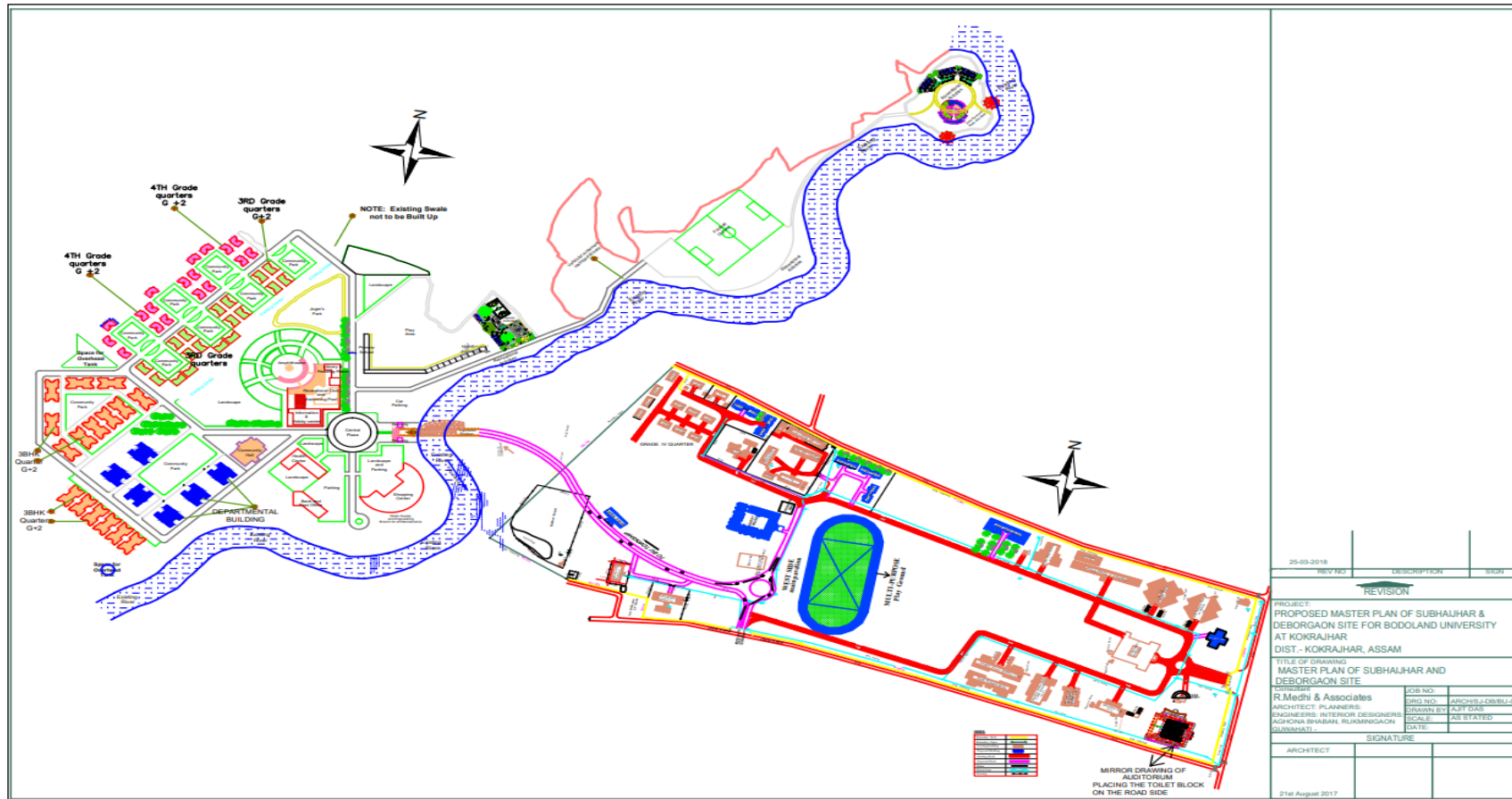
Sr.no.	Building Name	Total Area Sq.mt.
1	Administrative	2000
2	Academic Science Building	860
3	Teaching Staff Quarter	240
4	Vice Chancellor Residence Complex	520
Technical Staff Quarter		
5	Grade IV	125
6	Grade III	152
7	Academic Art	957.8
8	Academic Art	957.8
9	New Science	289
10	Library	306
11	Assam Type	865
12	Bodo Study Centre	1007.5
13	New teaching Staff Quarter	240
14	Officers Quarter	331.36
15	Art building	938.5
16	SC Girls Hostel	348
17	ST Girls Hostel	348
18	Girls Hostel	468
19	Girls Hostel	468
20	ST Boys Hostel	468
21	General Boys Hostel	348
22	PSGU Office Building	120
23	Canteen Building	270
24	Auditorium Hall	1500
25	Technology Incubation Centre	510
26	Development Play Ground	40000
27	Chemistry Department	860
Haldibhari Complex		
28	Teaching Staff Quarter	240
29	Plant Tissue Culture lab	540
30	Dept. of Zoology	796
31	Dept. of Botany	796



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1.3 University layout of campus



REV NO	DESCRIPTION	SIGN
REVISION		
PROJECT PROPOSED MASTER PLAN OF SUBHAJHAR & DEBORGAON SITE FOR BODOLAND UNIVERSITY AT KOKRAJHAR DIST. - KOKRAJHAR, ASSAM		
TITLE OF DRAWING MASTER PLAN OF SUBHAJHAR AND DEBORGAON SITE		
PREPARED BY R. Madni & Associates		
ARCHITECT, PLANNERS, ENGINEERS, INTERIOR DESIGNERS, ARCHITECTS, DESIGNERS, SURVEYORS, PLANNING, CONSULTANTS		
JOB NO.	ARCHITECT'S DESIGN NO.	
DRAWN BY	SCALE	AS STATED
DATE		
ARCHITECT	SIGNATURE	
21st August 2017		



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1.4 About Energy Audit

An energy audit helps to understand more about the ways energy is used in any plant and helps in identifying areas where waste may occur and scope for improvement exists. The overall energy efficiency from generation to the final consumer becomes 50%. Hence one unit saved in the end user is equivalent to two units generated in the power plant.

An energy audit is the most efficient way to identify the strength and weaknesses of energy management practices and to find a way to solve problems. An energy audit is a professional approach to utilizing economic, financial, social, and natural resources responsibly. Energy audits “adds value” to management control and are a way of evaluating the system.

Empirical Exergy Private Limited (EEPL), Indore M.P. carried out the “Energy Audit” at the site to find gaps in the energy consumption pattern for **Bodoland University, Kokharjhar (Assam)**. A technical report is prepared as per the need and the requirement of the project.

1.5 Objectives of Energy Auditing

An energy audit provides a vital information base for an overall energy conservation program covering essentially energy utilization analysis and evaluation of energy conservation measures. It aims at:

- Identifying the quality and cost of various energy inputs.
- Assessing the present pattern of energy consumption in different cost centers of operations.
- Relating energy inputs and production output.
- Identifying potential areas of the thermal and electrical energy economy.
- Highlighting wastage in major areas.
- Fixing of energy-saving potential targets for individual cost centers.
- Implementation of measures for energy conservation & realization of savings.



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1.6 Methodology

The methodology adopted for achieving the desired objectives viz.: Assessment of the current operational status and energy savings includes the following:

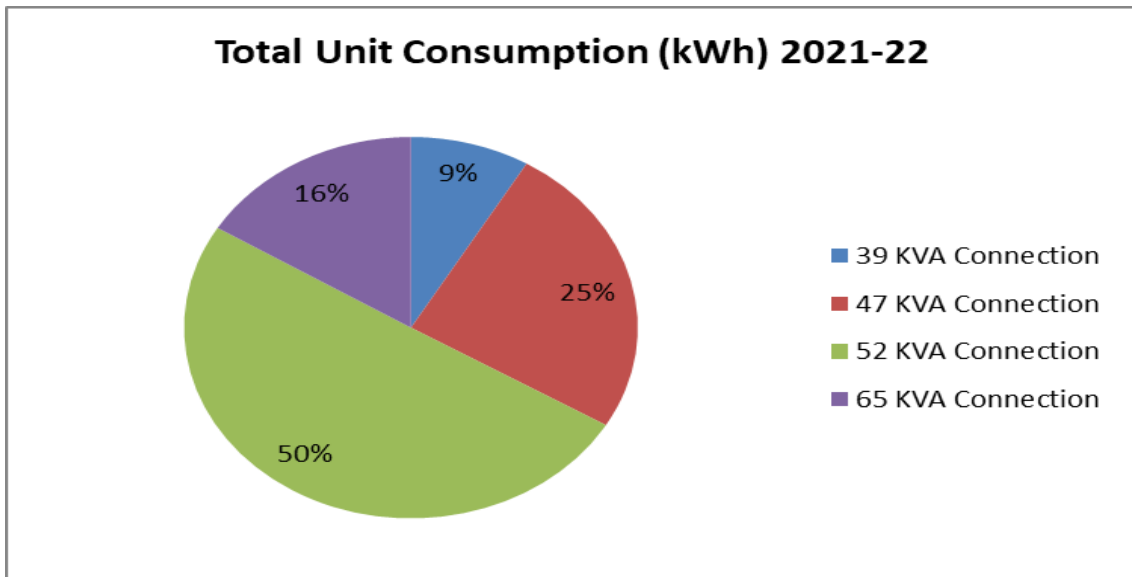
- ✚ Discussions with the concerned officials for identification of major areas of focus and other related systems.
- ✚ A team of engineers visited the site and had discussions with the concerned officials/supervisors to collect data/information on the operations and load distribution within the plant and the same for the overall premises. The data were analyzed to arrive at a baseline energy consumption pattern.
- ✚ Measurements and monitoring with the help of appropriate instruments including continuous and/or time-lapse recording, as appropriate and visual observations were made to identify the energy usage pattern and losses in the system.
- ✚ Trend analysis of costs and consumptions.
- ✚ Capacity and efficiency test of major utility equipments, wherever applicable.
- ✚ Estimation of various losses
- ✚ Computation and **in-depth analysis** of the collected data, including utilization of computerized analysis and other techniques as appropriate, were done to draw inferences and to evolve suitable energy conservation plan/s for improvements/reduction in specific energy consumption.



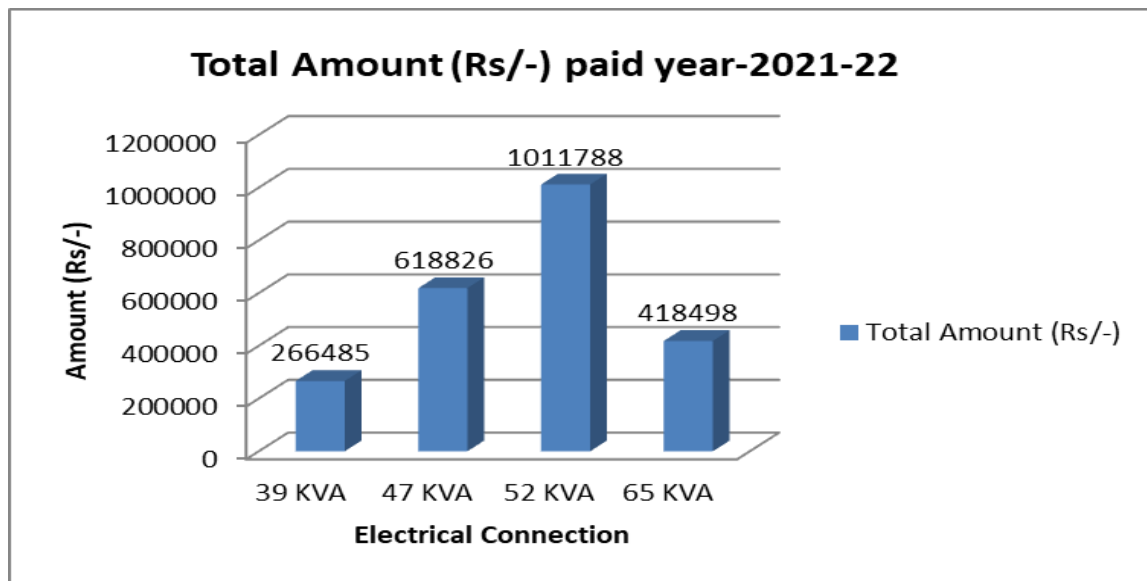
1.7 Present Energy Scenario

University uses energy in the form of electricity purchased from Assam Power Distribution company limited (APDCL) with the help of 11 kV feeders.

University has total 04 No's electrical connection with total contract demand 203 KVA. Annual energy consumption **2,64,546 units** and total billing amount about **Rs. 23, 15,597/-** for the period from July-2021 to Jun-2022. University 02 No's solar system on incubation center and new girl's hostel .Total Capacity of the solar system is 14 kWp.



Graphical Presentation of unit consumption Year-2021-22



Graphical presentation of total amount Year-2021-22



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CHAPTER- 2
POWER SUPPLY SYSTEM

2.1 Transformers

The power supply for the Bodoland University is from Assam Power Distribution Company Ltd (APDCL). There are 4 electricity connections 39 KVA, 47 KVA, 52 KVA and 65 KVA. With 04 Transformer. Detiles of the transformer is given table.

Sr. No.	Items	Technical Specification of Transformer -01	Technical Specification of Transformer -02
1	Location	Faculty Quarter	Back Side of Canteen
2	Make	Technovol	Technovol
3	Year	2003	2013
4	Makesr Sr.No.	T/63/1445	T/63/1445
5	Capacity	63	100
6	Voltage (HV/LV)	11000/433	11000/433
7	Current (HV/LV)	3.31/84	5.25/13.34
8	Frequency	50	50
9	Impedance Volt	4.56	4.5
10	Vector Group	Dyn-11	Dyn-11
11	Type of cooling	ONAN	ONAN



Sr. No.	Items	Technical Specification of Transformer -03	Technical Specification of Transformer -04
1	Location	Back side of Dhwnshree Hall	New Girls Hostel
2	Make	Prag Electrical Pvt. Ltd.	KALITA
3	Year	2010	2017
4	Capacity	100	63
5	Voltage (HV/LV)	11000/433	11000/433
6	Current (HV/LV)	525/13334	3.31/84
7	Frequency	50	50
8	Impedance Volt	4.4	4.5
9	Vector Group	Dyn-11	Dyn-11
10	Type of cooling	ONAN	ONAN

Power Measurement of Transformer:-

Sr. No.	Location	Voltage (V)	Current (A)	Power Factor	Input power (KW)	Input KVA	Loading %
1	New Girls Hostel	403	9.6	0.90	3.48	3.9	6.14
2	Staff Quarter	405	10.5	0.90	3.83	4.3	6.75
3	Near Canteen	403	21.4	0.90	7.76	8.6	8.62
4	Near Dhanashree Hall	404	19	0.90	6.91	7.7	7.68

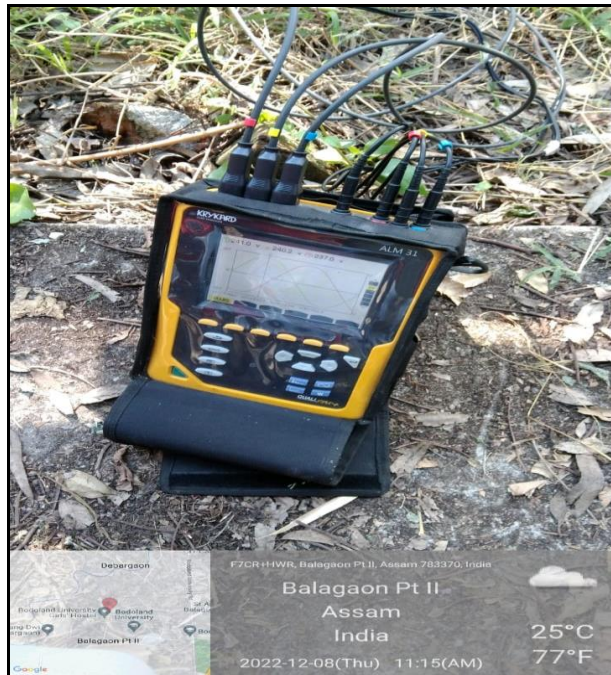
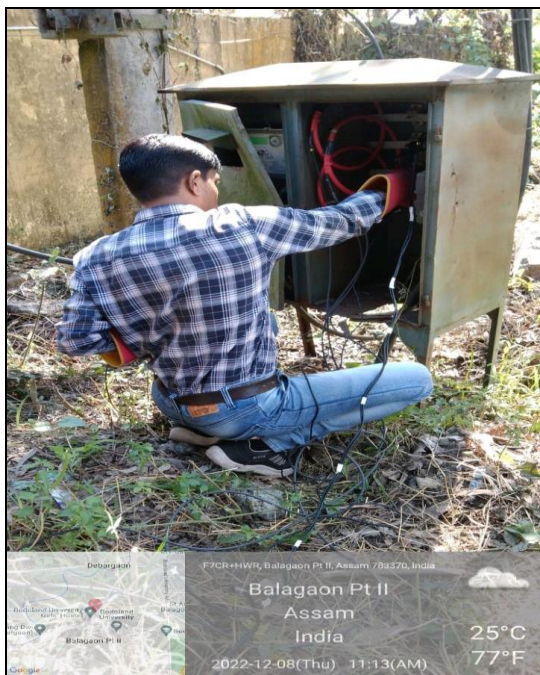


Figure: - Transformer Power measurement



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Transformer loading year 2019-2022 at 39 KVA

Sr. No	Month	Transformer Capacity (KVA)	Transformer loading % 2019-20	Transformer loading % 2020-21	Transformer loading % 2021-22
1	July	63	6	1	39
2	August	63	12	1	37
3	September	63	11	1	17
4	October	63	10	36	11
5	November	63	10	52	7
6	December	63	12	3	11
7	January	63	6	3	11
8	February	63	10	9	13
9	March	63	12	9	12
10	April	63	2	9	12
11	May	63	1	12	12
12	June	63	1	1	19
	Average	63	8	11.4	17

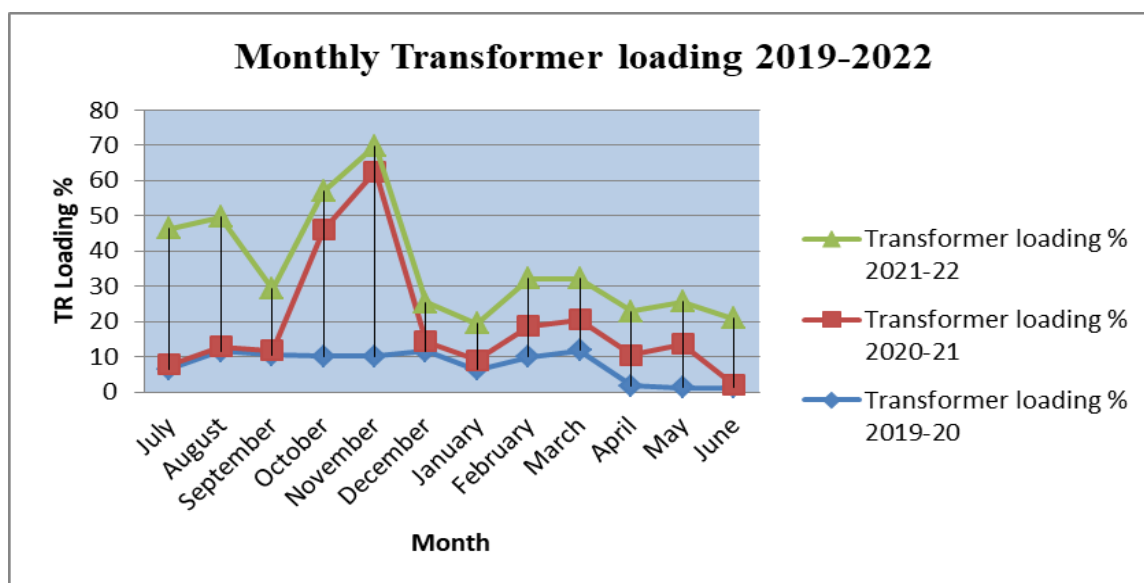


Figure: - Graphical presentation of transformer loading 2019 to 2022

Observation:-

- Average transformer loading is 8 % in July-2019 to Jun -2020. **Its Acceptable.**
- Average transformer loading is 11.4 % in July-2020 to Jun -2021. **Its Acceptable.**
- Average transformer loading is 17 % in July-2021 to Jun -2022. **Its Acceptable.**



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Transformer loading year 2019-2022 at 47 KVA

Sr. No	Month	Transformer Capacity (KVA)	Transformer loading % 2019-20	Transformer loading % 2020-21	Transformer loading % 2021-22
1	July	100	40	34	43
2	August	100	41	34	43
3	September	100	36	34	46
4	October	100	30	36	33
5	November	100	27	16	39
6	December	100	30	34	41
7	January	100	30	34	39
8	February	100	34	41	56
9	March	100	43	41	42
10	April	100	30	41	43
11	May	100	27	34	44
12	June	100	27	43	51
	Average	100	33	35	43

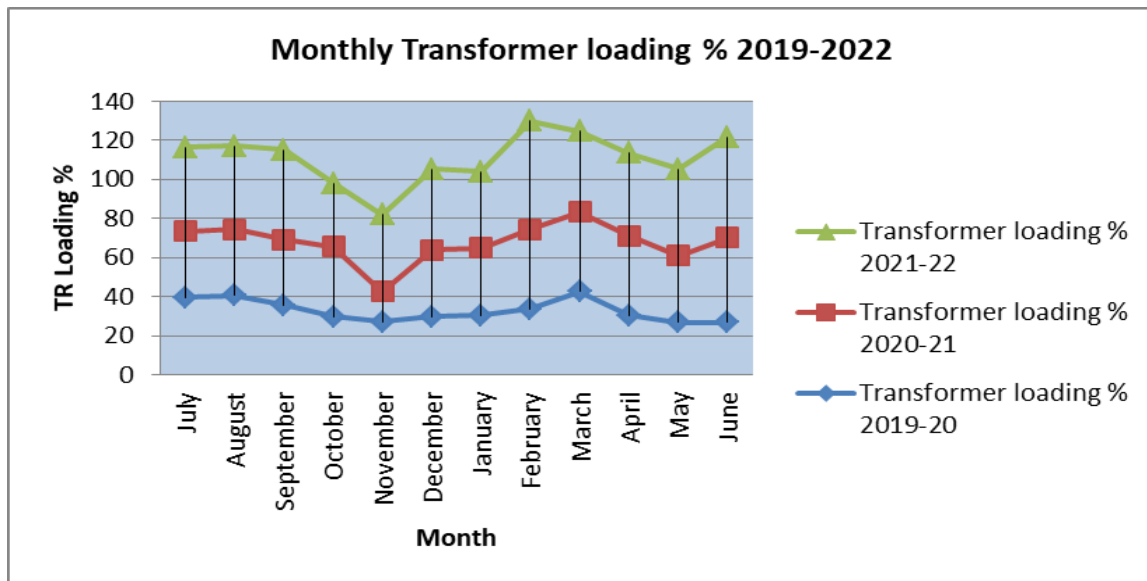


Figure: - Graphical presentation of transformer loading 2019 to 2022

Observation:-

- ✚ Average transformer loading is 33 % in July-2019 to Jun -2020. **Its Acceptable.**
- ✚ Average transformer loading is 35 % in July-2020 to Jun -2021. **Its Acceptable.**
- ✚ Average transformer loading is 43 % in July-2021 to Jun -2022. **Its Acceptable**



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✚ **Transformer loading year 2019-2022 at 52 KVA**

Sr. No	Month	Transformer Capacity (KVA)	Transformer loading % 2019-20	Transformer loading % 2020-21	Transformer loading % 2021-22
1	July	63	35.4	3	33.38
2	August	63	30.0	3	33.38
3	September	63	5.8	3	33.38
4	October	63	4.3	4	33.38
5	November	63	5.2	3	33.38
6	December	63	0.6	3	33.38
7	January	63	2.5	30	33.38
8	February	63	4.0	29	33.38
9	March	63	4.5	29	33.38
10	April	63	2.3	38	33.38
11	May	63	2.6	38	33.38
12	June	63	3.0	33	33.38
	Average	63	8.4	18	33.38

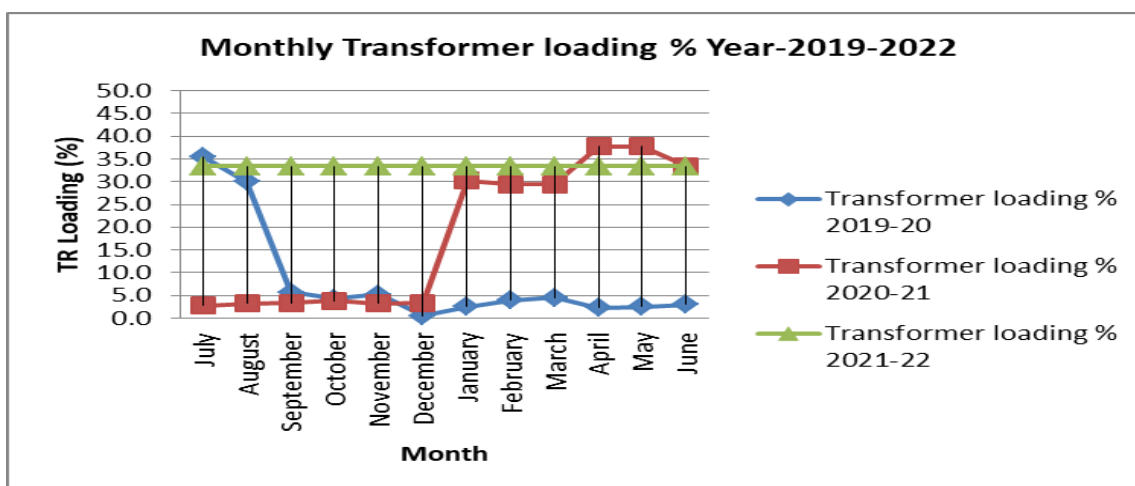


Figure: - Graphical presentation of transformer loading 2019 to 2022

Observation:-

- ✚ Average transformer loading is 8.4 % in July-2019 to Jun -2020. **Its Acceptable.**
- ✚ Average transformer loading is 18 % in July-2020 to Jun -2021. **Its Acceptable.**
- ✚ Average transformer loading is 33.38 % in July-2021 to Jun -2022. **Its Acceptable.**



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Transformer loading year 2019-2022 at 65 KVA

Sr. No	Month	Transformer capacity (KVA)	Transformer loading % 2019-20	Transformer loading % 2020-21	Transformer loading % 2021-22
1	July	100	48	11	24
2	August	100	54	20	24
3	September	100	52	19	40
4	October	100	44	19	37
5	November	100	53	20	20
6	December	100	25	22	16
7	January	100	24	27	16
8	February	100	26	23	18
9	March	100	34	29	24
10	April	100	10	30	27
11	May	100	30	30	27
12	June	100	40	29	55
	Average	100	37	23	27

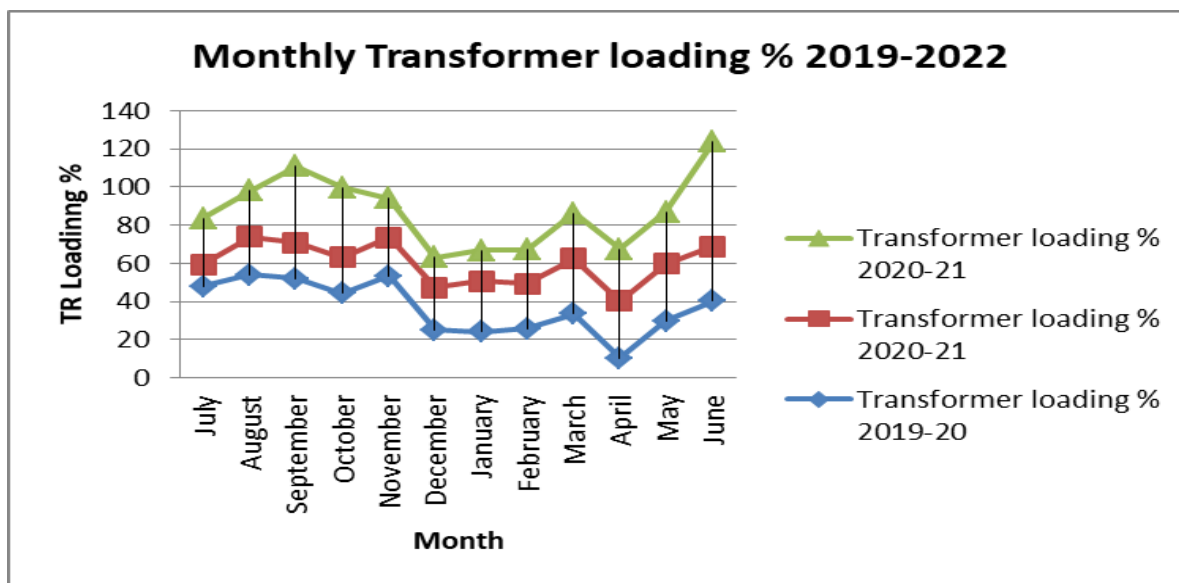


Figure: - Graphical presentation of transformer loading 2019 to 2022

Observation:-

- ✚ Average transformer loading is 37 % in July-2019 to Jun -2020. **Its Acceptable.**
- ✚ Average transformer loading is 23 % in July-2020 to Jun -2021. **Its Acceptable.**
- ✚ Average transformer loading is 27 % in July-2021 to Jun -2022. **Its Acceptable.**



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2.2 DG Sets

There are 7 DG sets on the university campus. Details of the DG Sets are given table.

Table: - Technical specifications for DG sets

Sr.No.	Parameter	Technical Specification DG Set-01	Technical Specification DG Set-02
1	Make	Kirloskar	Kirloskar
2	Location	Girls hostel	Boys hostel
3	M/C No	LAS3E18G15180-H	LAS3E18G151223-H
4	Capacity (KVA)	15	15
5	Rated voltage	415	415
6	Frequency	50	50
7	Power factor	0.8	0.8
8	RPM	1500	1500
9	Phase	3	3



Figure: - DG sets for hostels



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Sr.No.	Parameter	Technical Specification DG Set-03	Technical Specification DG Set-04
1	Make	Leory-somer	Kirloskar
2	Location	Incubation	Central library
3	M/C No	LCS3B217J218360	LBS3K21E4646-H
4	Capacity (KVA)	85.5	62.5
5	Rated Voltage	415	415
6	Frequency	50	50
7	Power factor	0.8	0.8
8	RPM	1500	1500
9	Phase	3	3





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Sr.No.	Parameter	Technical Specification DG Set-05	Technical Specification DG Set-06
1	Make	Kirloskar	Kirloskar
2	Location	Chemistry DG	Dr.Ambedkar Building
3	M/C No	CS3A008A32991	LAS3E18G15061-H
4	Capacity (KVA)	20	15
5	Rated Voltage	415	415
6	Frequency	50	50
7	Power factor	0.8	0.8
8	RPM	1500	1500
9	Phase	3	3





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Sr.No.	Parameter	Technical Specification DG Set-07
1	Make	Kirloskar
2	Location	Admin
3	M/C No	A2360630-405
4	Capacity (KVA)	63
5	Rated Voltage	415
6	Frequency	50
7	Power factor	0.8
8	RPM	1500
9	Phase	3

Observation:-

- DG sets are used only in case of grid power failure.
- There is no system to monitor fuel consumption w.r.t. unit generation.



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2.3 Solar Photovoltaic System.

University have 14 kWp solar system installed on new girl's hostel building (8 kWp) and Incubation centre (6 kWp) System. The details are given below.

Plant-01:- New girls hostel

Sr. No	Description	Technical Specification
1	Plant Information	
1.1	Plant capacity	08 kWp
1.2	Locations	New girl's hostel.
1.3	No of PV panels	32 No's
2	PV Panel Details	
2.1	Make	Sukam power system limited
2.2	Panel Type	Poly-crystalline
2.3	Panel wattage	250 Wp
2.4	Open circuit voltage	37.20 V
2.5	Short circuit current	8.75 A
2.6	Inverter make	Alfa
2.7	Inverter capacity	5000 VA

Plant-02:- Incubation Centre

Sr. No	Description	Technical Specification
1	Plant Information	
1.1	Plant capacity	06 kWp
1.2	Locations	Incubation Centre
1.3	No of PV panels	24 No's
2	PV Panel Details	
2.1	Make	Solite German Technology
2.2	Panel type	Poly-crystalline
2.3	Panel wattage	125 Wp



Photographs of Solar Plant:-



Figure 2.6:- Solar Plant

Observation:-

- ✚ 08 KWp solar system installed on new girls hostel. Garneted unit are used in new girls hostel. And 06 KWp Solar system installed on incubation center .Garneted unit are used in incubation center.
- ✚ There are requirement to install energy monitoring system for monitoring of solar unit per day.



**CHAPTER- 3
ELECTRICITY BILL ANALYSIS**

3.0 Electricity Bill Analysis

Electricity bills for the last three years (2019-22) were analysed. Detailed unit consumption, overall per unit charges, demand analysis, transformer loading etc.

Table 3.0:- Electricity bill analysis last 03 Year (2019-2022)

Sr. No	Connection	Location	Unit Consumption (kWh) 2019-20	Unit Consumption (kWh) 2020-21	Unit Consumption (kWh) 2021-22
1	39 KVA Connection	New Girl Hostel	11,840	6,742	22,519
2	47 KVA Connection	Near Canteen	66,947	61,142	66,196
3	52 KVA Connection	Back side of Dwanshree Hall	13,749	52,283	1,32,881
4	65 KVA Connection	Quarter	61,876	44,905	42,950
		Total	1,54,412	1,65,072	2,64,546

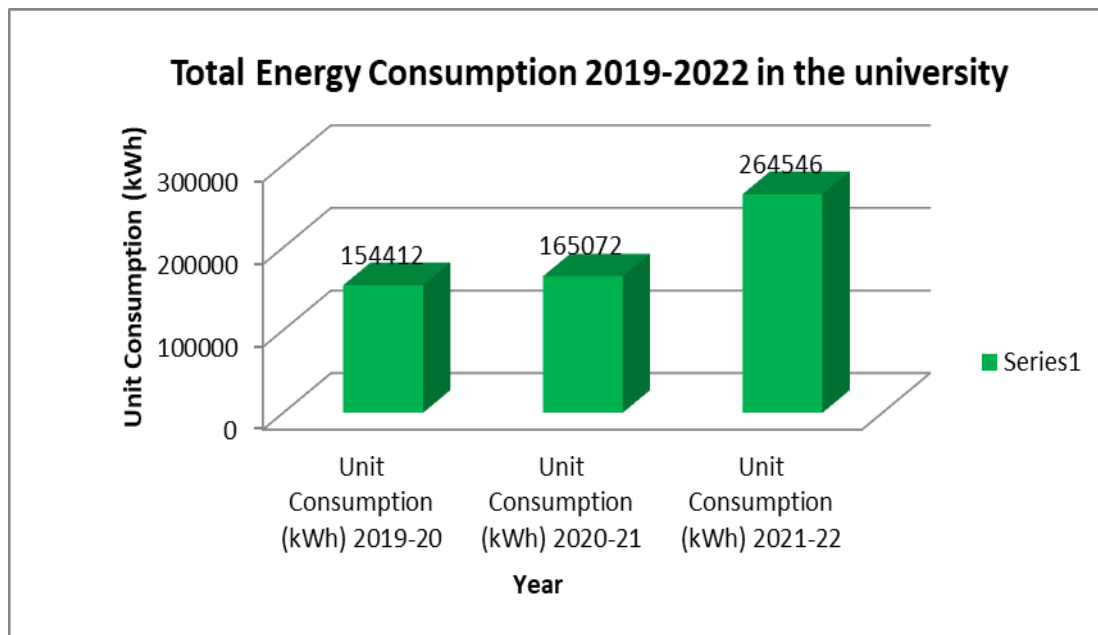


Figure 3.0:-Graphical presentation of total unit consumption Year-2019-2022



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3.1 Bill analysis last three Year (2019-2022) at 39 KVA Connection

3.1.1 Monthly Energy Consumption 2019-2022 at 39 KVA Connection

The monthly electrical consumption for the university is given in the table.

Table 3.1 Energy consumption the year 2019 to 2022

Sr. No	Month	Unit Consumption (kWh) 2019-20	Unit Consumption (kWh) 2020-21	Unit Consumption (kWh) 2021-22
1	July	331	388	3,913
2	August	1,945	388	5,430
3	September	2,017	416	191
4	October	1,206	315	457
5	November	1,203	1,032	1,178
6	December	1,680	56	1,453
7	January	765	53	1,441
8	February	1,224	1,116	1,366
9	March	912	1,148	1,555
10	April	192	1,079	1,178
11	May	181	635	1,252
12	June	185	116	3,105
	Total	11,840	6,742	22,519

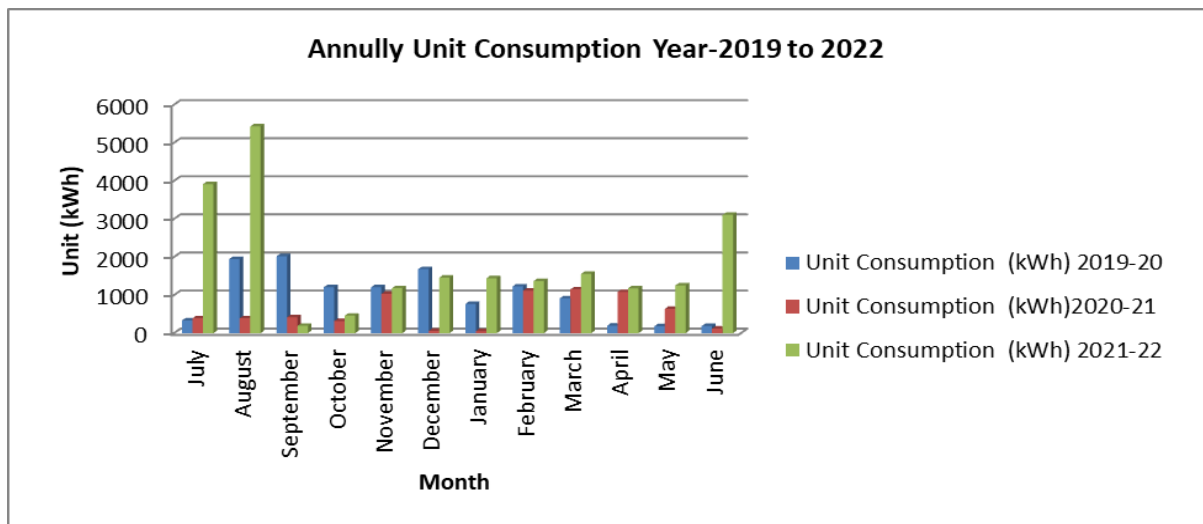


Figure 3.1:- Graphical presentation of annually unit consumption for the year 2019-22

Observation:

- ✚ Total energy consumption July-2019 to Jun-2020 are 11,840 units
- ✚ Total energy consumption July-2020 to Jun-2021 are 6,742 units
- ✚ Total energy consumption July-2021 to Jun-2022 are 22,519 units



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3.1.2 Monthly demand analysis 2019 to 2022 at 39 KVA Connection

The monthly demand consumption for the university is given in the table.

Table 3.2:- Monthly demand analysis (KVA) consumption pattern year 2019-2022

Sr. No	Month	Contract Demand (KVA)	Maximum Demand (KVA) 2019-20	Maximum Demand (KVA) 2020-21	Maximum Demand (KVA) 2021-22
1	July	39	4	0.8	24
2	August	39	7	0.8	23
3	September	39	7	0.8	11
4	October	39	6	22.6	7
5	November	39	6	33	5
6	December	39	7	1.68	7
7	January	39	4	1.68	7
8	February	39	6	5.56	8
9	March	39	7	5.6	7
10	April	39	1	5.6	8
11	May	39	1	7.8	8
12	June	39	1	0.52	12
Minimum Demand (KVA)			1	0.52	5
Maximum Demand (KVA)			7	33	24
Average Demand (KVA)			5	8.6	11

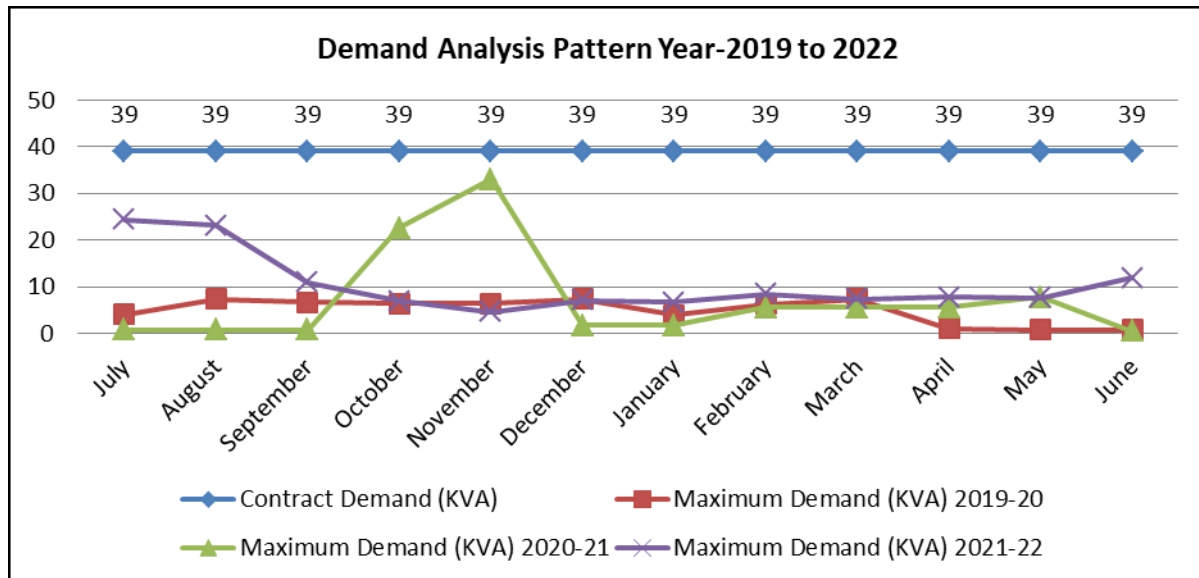


Figure 3.2:- Graphical presentation of demand consumption in the university year 2019-2022

Observation: It was observed that the contract demand of the university is 39 kVA at this connection. There is a large variation in maximum demand. It is a maximum of 33 kVA in the month of Nov-2020 and a minimum of 0.5 kVA in Jun- 2021 in period July-2019 to Jun-2022.



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3.1.3 Overall per unit charges year 2019 to 2022 at 39 KVA Connection

Table 3.3:- Overall per unit charges for the university is given in the table.

Sr. No	Month	Overall per unit charges (Rs/kWh) 2019-20	Overall per unit charges (Rs/kWh) 2020-21	Overall per unit charges (Rs/kWh) 2021-22
1	July	30.3	27.4	9.5
2	August	11.6	27.4	9.0
3	September	11.4	25.5	49.5
4	October	14.1	24.4	24.3
5	November	13.9	14.9	13.9
6	December	12.2	141.7	12.7
7	January	16.6	152.2	12.8
8	February	13.4	13.9	12.7
9	March	15.9	14.5	12.6
10	April	46.4	14.5	14.9
11	May	49.7	19.8	15.0
12	June	47.7	71.7	10.6

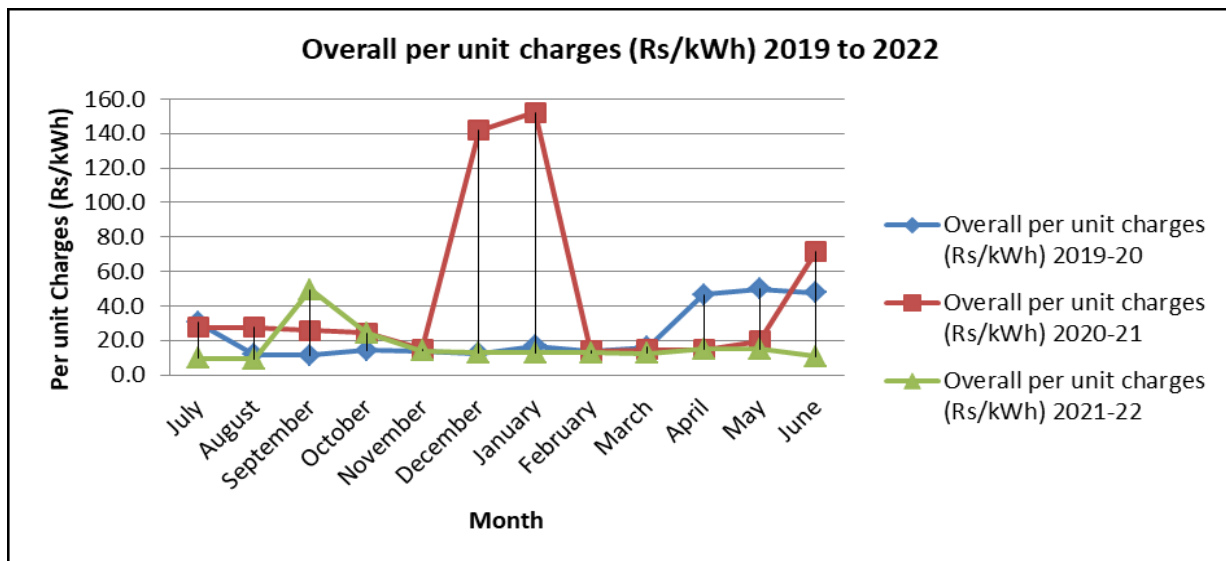


Figure 3.3:- Graphical presentation of actual per-unit charges for years 2019-2022

Observation:

- ✚ Overall per unit charges Rs/kWh is Rs 47.7 in Year-2019-20. It is very higher side due lower energy consumption of April and May-2020
- ✚ Overall per unit charges Rs/kWh is Rs 71.7 in Year-2020-21 It is very higher side due lower energy consumption of Decemeber-2020 and Jan-2021
- ✚ Overall per unit charges Rs/kWh is Rs 10.6 in Year-2021-22



3.2 Bill Analysis last three Year (2019-2022) at 47 KVA Connection

3.2.1 Monthly energy consumption 2019-2022 at 47 KVA Connection

The monthly electrical consumption for the university is given in the table.

Table 3.2.1 Energy consumption the year 2019 to 2022

Sr. No	Month	Unit Consumption (kWh) 2019-20	Unit Consumption (kWh)2020-21	Unit Consumption (kWh) 2021-22
1	July	7,683	5,382	5,635
2	August	7,641	3,234	5,627
3	September	7,460	3,220	675
4	October	5,154	8,834	877
5	November	5,925	3,497	4,924
6	December	5,824	4,580	6,240
7	January	4,753	4,156	6,828
8	February	6,189	6,602	2,857
9	March	5,554	7,287	10,489
10	April	3,403	6,920	5,401
11	May	3,589	1,758	5,760
12	June	3,772	5,671	10,883
	Total	66,947	61,142	66,196

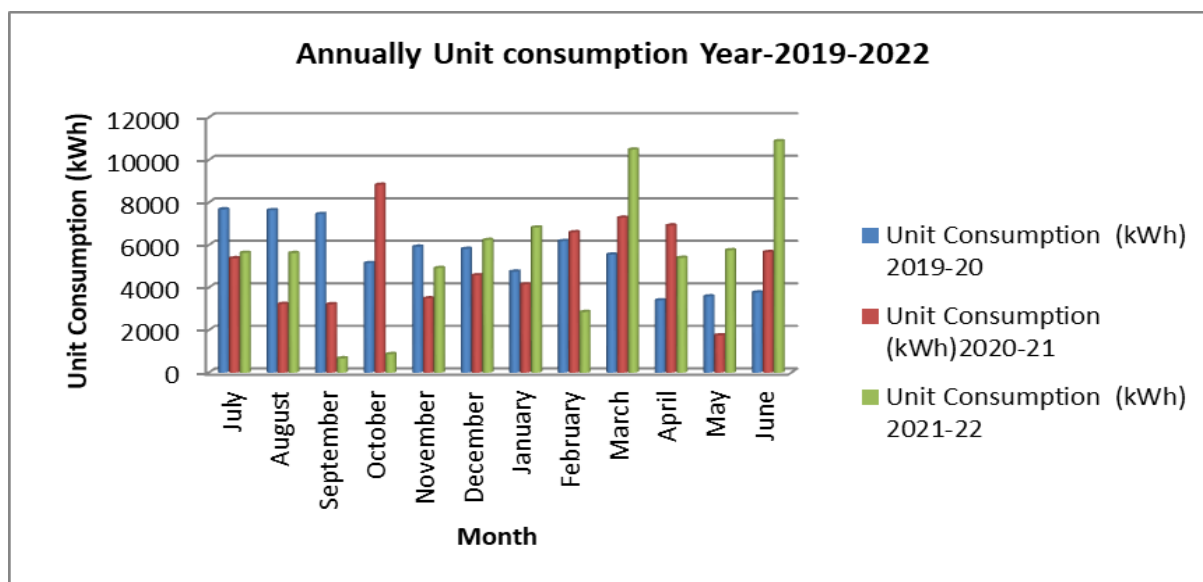


Figure 3.2.1:- Graphical presentation of annually unit consumption for the year 2019-22

Observation

- ✚ Total energy consumption July-2019 to Jun-2020 is 66,947 units
- ✚ Total energy consumption July-2020 to Jun-2021 is 61,142 units
- ✚ Total energy consumption July-2021 to Jun-2022 is 66,196 units



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3.2.2 Monthly demand analysis 2019 to 2022 at 47 KVA Connection

The monthly demand consumption for the university is given in the table.

Table 3.2.2:- Monthly demand analysis (KVA) consumption pattern year 2019-2022

Sr. No	Month	Contract Demand (KVA)	Maximum Demand (KVA) 2019-20	Maximum Demand (KVA) 2020-21	Maximum Demand (KVA) 2021-22
1	July	47	25	21	27
2	August	47	26	21	27
3	September	47	22	21	29
4	October	47	19	23	21
5	November	47	17	10	25
6	December	47	19	22	26
7	January	47	19	22	25
8	February	47	21	26	35
9	March	47	27	26	26
10	April	47	19	26	27
11	May	47	17	21	28
12	June	47	17	27	32
	Minimum Demand (KVA)		17	10	21
	Maximum Demand (KVA)		27	27	35
	Average Demand (KVA)		21	22	27

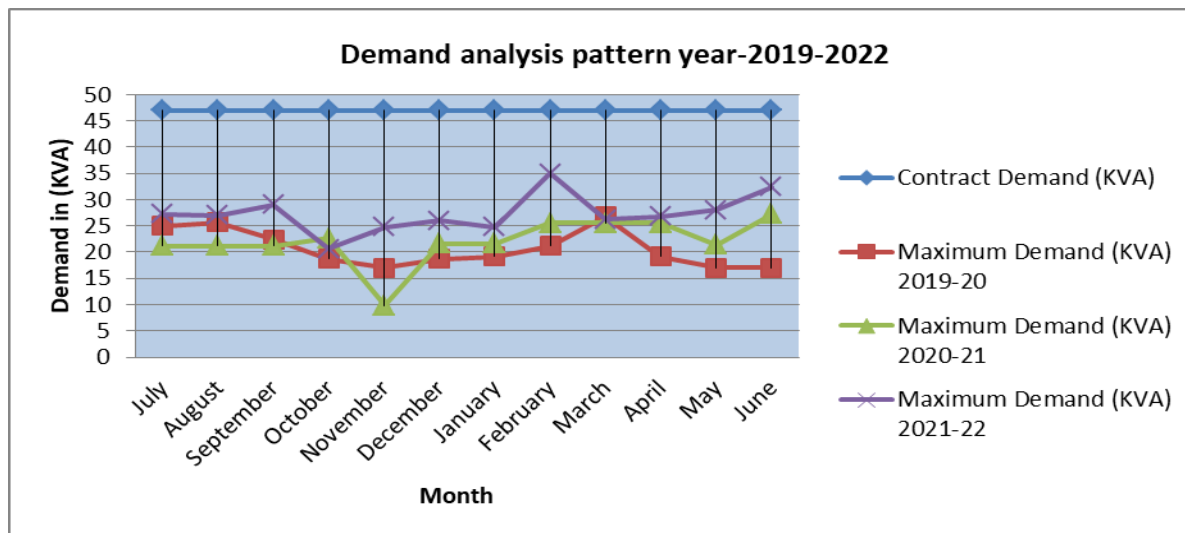


Figure 3.2.2:- Graphical presentation of demand consumption year 2019-2022

Observation: It was observed that the contract demand of the university is 47 kVA at this connection. There is a large variation in maximum demand. It is a maximum of 35 kVA in the month of Feb-2022 and a minimum of 10 kVA in Nov 2020 in period July-2019 to Jun-2022.



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3.2.3 Overall per unit charges 2019 to 2022 at 47 KVA Connection

Table 3.2.3:- Overall per unit charges for the university is given in the table.

Sr. No	Month	Overall per unit charges (Rs/kWh) 2019-20	Overall per unit charges (Rs/kWh) 2020-21	Overall per unit charges (Rs/kWh) 2021-22
1	July	9.1	9.5	9.3
2	August	9.1	10.7	9.3
3	September	9.2	10.5	13.1
4	October	9.7	8.8	18.0
5	November	9.4	10.6	9.4
6	December	9.5	9.8	9.0
7	January	9.8	10.1	8.9
8	February	9.3	9.0	10.4
9	March	9.6	9.1	8.5
10	April	10.4	9.0	9.9
11	May	10.3	13.2	9.9
12	June	10.1	9.2	8.9
	Average	9.6	9.9	10.4

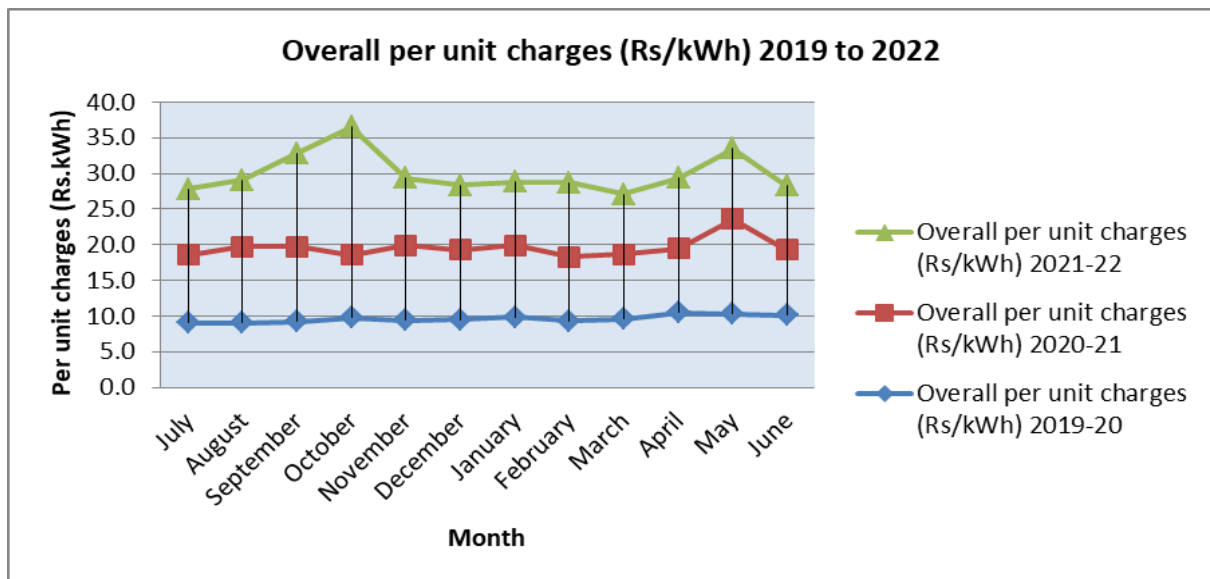


Figure 3.2.3:- Graphical presentation of actual per-unit charges for years 2019-2022

Observation:

- ✚ Overall per unit charges Rs/kWh is Rs 9.6 in Year-2019-20
- ✚ Overall per unit charges Rs/kWh is Rs 9.9 in Year-2020-21
- ✚ Overall per unit charges Rs/kWh is Rs 10.4 in Year-2021-22



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3.3 Bill Analysis last three Year (2019-2022) at 52 KVA Connection

3.3.1 Monthly Energy Consumption 2019-2022 at 52 KVA Connection

The monthly electrical consumption for the university is given in the table.

Table 3.3.1 Energy consumption the year 2019 to 2022

Sr. No	Month	Unit Consumption (kWh) 2019-20	Unit Consumption (kWh)2020-21	Unit Consumption (kWh) 2021-22
1	July	7,318	484	8,748
2	August	304	646	8,804
3	September	576	560	9,717
4	October	590	614	10,023
5	November	462	621	9,690
6	December	586	538	10,322
7	January	818	5,549	10,322
8	February	780	8,001	9,323
9	March	798	8,830	10,322
10	April	472	8,706	12,360
11	May	478	8,982	15,326
12	June	567	8,752	17,922
	Total	13,749	52,283	1,32,881

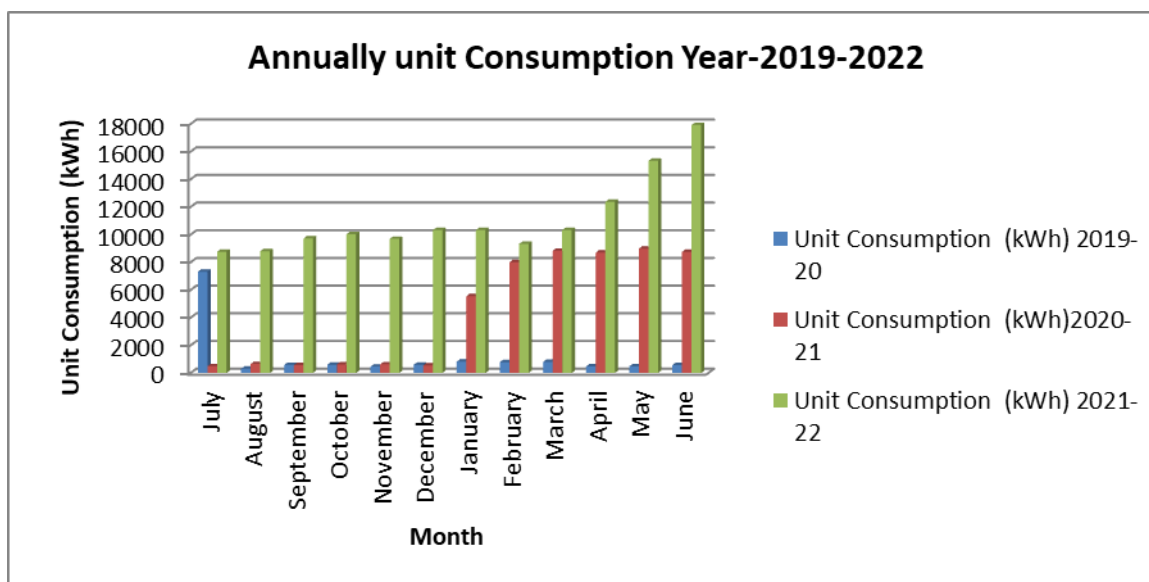


Figure 3.3.1:- Graphical presentation of annually unit consumption for the year 2019-22

Observation:

- ✚ Total energy consumption July-2019 to Jun-2020 is 13,749 units
- ✚ Total energy consumption July-2020 to Jun-2021 is 52,283 units
- ✚ Total energy consumption July-2021 to Jun-2022 is 1,32,881 units



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3.3.2 Monthly demand analysis 2019 to 2022 at 52 KVA Connection

The monthly demand consumption for the university is given in the table.

Table 3.3.2:- Monthly demand analysis (KVA) consumption pattern year 2019-2022

Sr. No	Month	Contract Demand (KVA)	Maximum Demand (KVA) 2019-20	Maximum Demand (KVA) 2020-21	Maximum Demand (KVA) 2021-22
1	July	52	35	3	33
2	August	52	30	3	33
3	September	52	6	3	33
4	October	52	4	4	33
5	November	52	5	3	33
6	December	52	1	3	33
7	January	52	3	30	33
8	February	52	4	29	33
9	March	52	5	29	33
10	April	52	2	38	33
11	May	52	3	38	33
12	June	52	3	33	33
	Minimum Demand (KVA)		1	3	33
	Maximum Demand (KVA)		35	38	33
	Average Demand (KVA)		10	18	33

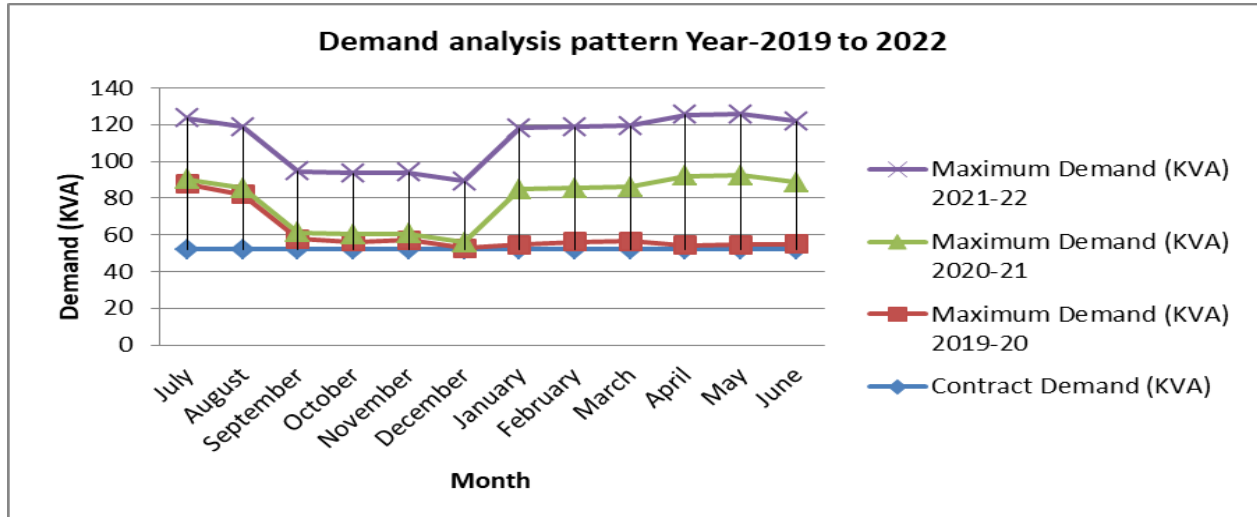


Figure 3.3.2:- Graphical presentation of demand consumption in the university year 2019-2022

Observation:

- ✚ It was observed that the contract demand of the university is 52 kVA at this connection. There is a large variation in maximum demand. It is a maximum of 38 kVA in the Month of May-2022 and a minimum of 1 kVA in Dec- 2019 in period July-2019 to Jun-2022.
- ✚ Maximum demand is showing constant reading 33 KVA in Year-2021-22 due to electrical meter not working condition.



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3.3.3 Overall per unit charges 2019 to 2022 at 52 KVA Connection

Table 3.3.3:-Overall per unit charges for the university is given in the table.

Sr. No	Month	Overall per unit charges (Rs/kWh) 2019-20	Overall per unit charges (Rs/kWh) 2020-21	Overall per unit charges (Rs/kWh) 2021-22
1	July	8.1	22.9	7.8
2	August	34.8	19.1	7.8
3	September	20.1	20.3	7.6
4	October	20.1	19.6	7.6
5	November	23.3	19.1	7.7
6	December	20.2	21.5	7.5
7	January	16.6	8.3	7.5
8	February	16.5	7.9	7.6
9	March	16.9	7.9	7.6
10	April	22.9	7.7	7.7
11	May	23.1	7.7	7.6
12	June	21.7	7.7	7.5
	Average	20.4	14.2	7.6

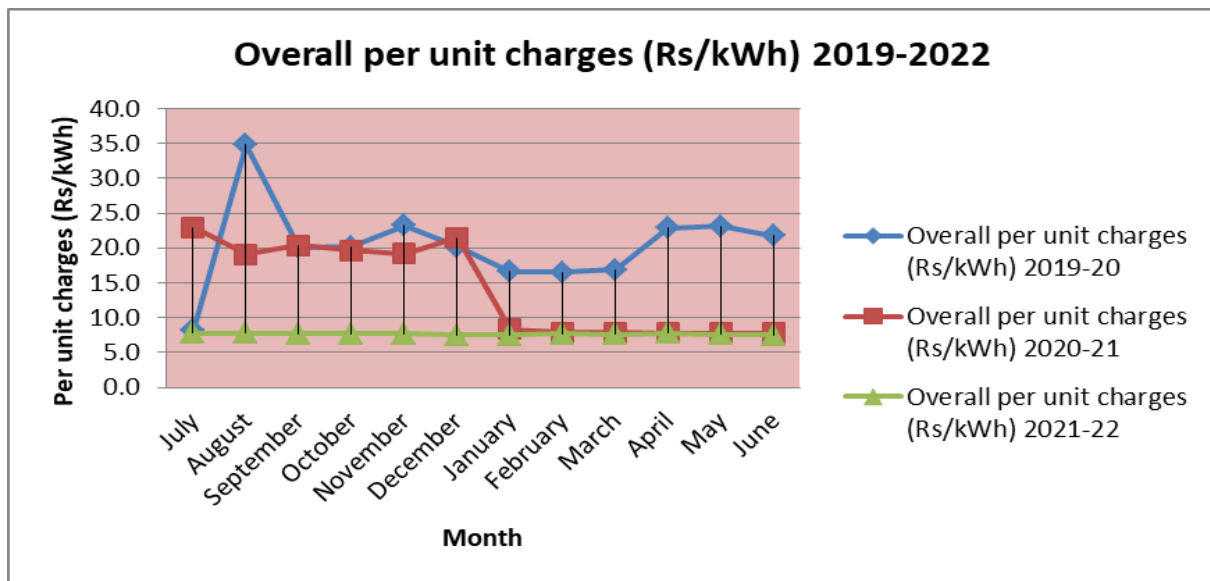


Figure 3.3.3:- Graphical presentation of actual per-unit charges for years 2019-2022

Observation:

- ✚ Overall per unit charges Rs/kWh is Rs 20.4 in Year-2019-20
- ✚ Overall per unit charges Rs/kWh is Rs 14.2 in Year-2020-21
- ✚ Overall per unit charges Rs/kWh is Rs 7.6 in Year-2021-22



3.4 Bill Analysis last three Year (2019-2022) at 65 KVA Connection

3.4.1 Monthly Energy Consumption 2019-2022 at 65 KVA Connection

The monthly electrical consumption for the university is given in the table.

Table 3.4.1 Energy consumption the year 2019 to 2022

Sr. No	Month	Unit Consumption (kWh) 2019-20	Unit Consumption (kWh) 2020-21	Unit Consumption (kWh) 2021-22
1	July	3,888	1,798	2,596
2	August	5,984	3,390	3,641
3	September	6,296	2,662	4,200
4	October	5,694	2,822	3,432
5	November	7,468	3,624	3,028
6	December	5,878	4,487	3,003
7	January	6,050	5,203	2,902
8	February	6,370	5,657	2,910
9	March	5,802	5,421	3,085
10	April	1,644	2,668	3,092
11	May	3,416	2,555	3,354
12	June	3,386	4,619	7,706
	Total	61,876	44,905	42,950

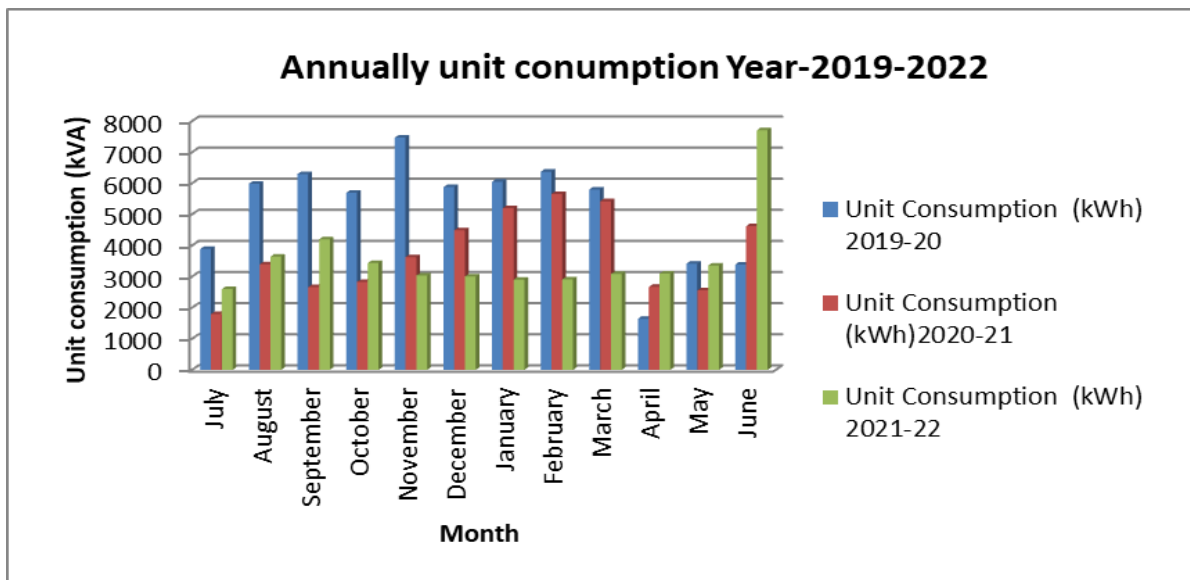


Figure 3.4.1:- Graphical presentation of annually unit consumption for the year 2019-22

Observation:

- ✚ Total energy consumption July-2019 to Jun-2020 is 61,876 units
- ✚ Total energy consumption July-2020 to Jun-2021 is 44,905 units
- ✚ Total energy consumption July-2021 to Jun-2022 is 42,950 units



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3.4.2 Monthly demand analysis 2019 to 2022 at 65 KVA Connection

The monthly demand consumption for the university is given in the table.

Table 3.4.2:- Monthly demand analysis (KVA) consumption pattern year 2019-2022

Sr. No	Month	Contract Demand (KVA)	Maximum Demand (KVA) 2019-20	Maximum Demand (KVA) 2020-21	Maximum Demand (KVA) 2021-22
1	July	65	48	11.4	24
2	August	65	54	19.8	24
3	September	65	52	18.8	40
4	October	65	44	18.6	37
5	November	65	53	20.2	20
6	December	65	25	22	16
7	January	65	24	26.8	16
8	February	65	26	23.4	18
9	March	65	34	28.82	24
10	April	65	10	29.82	27
11	May	65	30	29.82	27
12	June	65	40	28.6	55
	Minimum Demand (KVA)		10	11.4	16
	Maximum Demand (KVA)		54	29.8	55
	Average Demand (KVA)		36	22.8	29

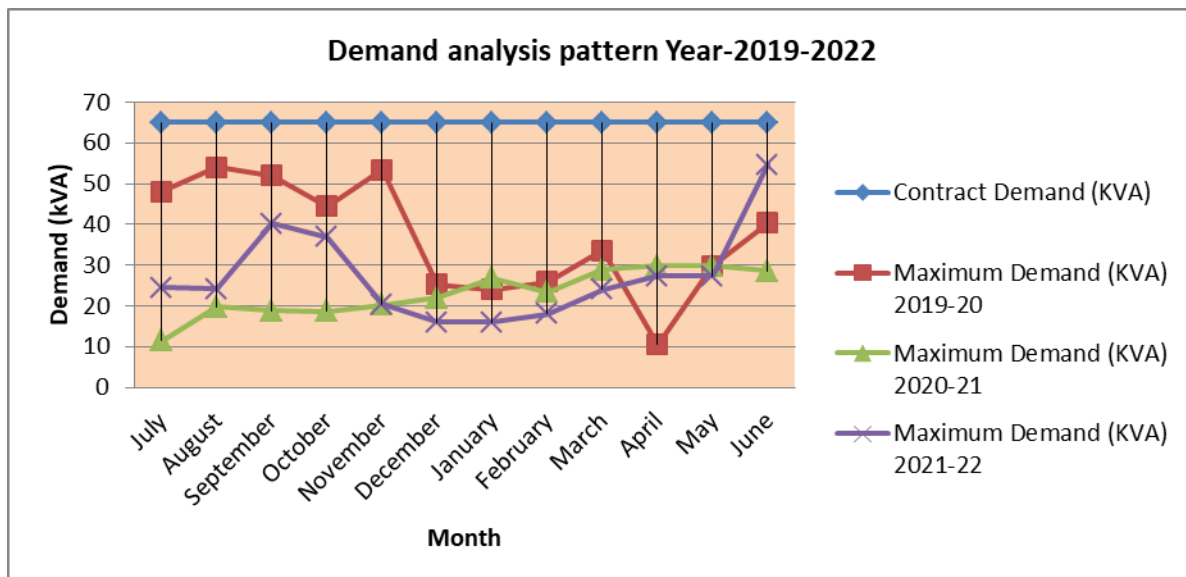


Figure 3.4.2:- Graphical presentation of demand consumption in the university year 2019-2022

Observation:

- It was observed that the contract demand of the university is 65 kVA at this connection. There is a large variation in maximum demand. It is a maximum of 55 kVA in the Month of Jun-2022 and a minimum of 10 kVA in April- 2020 in period July-2019 to Jun-2022.



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3.4.3 Overall per unit charges 2019 to 2022 at 65 KVA Connection

Table 3.4.3:-Overall per unit charges for the university is given in the table.

Sr. No	Month	Overall per unit charges (Rs/kWh) 2019-20	Overall per unit charges (Rs/kWh) 2020-21	Overall per unit charges (Rs/kWh) 2021-22
1	July	9.3	12.1	10.5
2	August	8.6	9.6	9.4
3	September	8.5	10.3	9.0
4	October	8.6	10.2	9.6
5	November	8.1	9.5	13.1
6	December	8.6	9.2	9.9
7	January	8.5	8.8	10.0
8	February	8.3	8.5	9.9
9	March	8.6	8.7	9.8
10	April	12.3	10.3	10.1
11	May	9.6	10.5	10.1
12	June	9.5	8.8	8.3
	Average	9.0	9.7	10.0

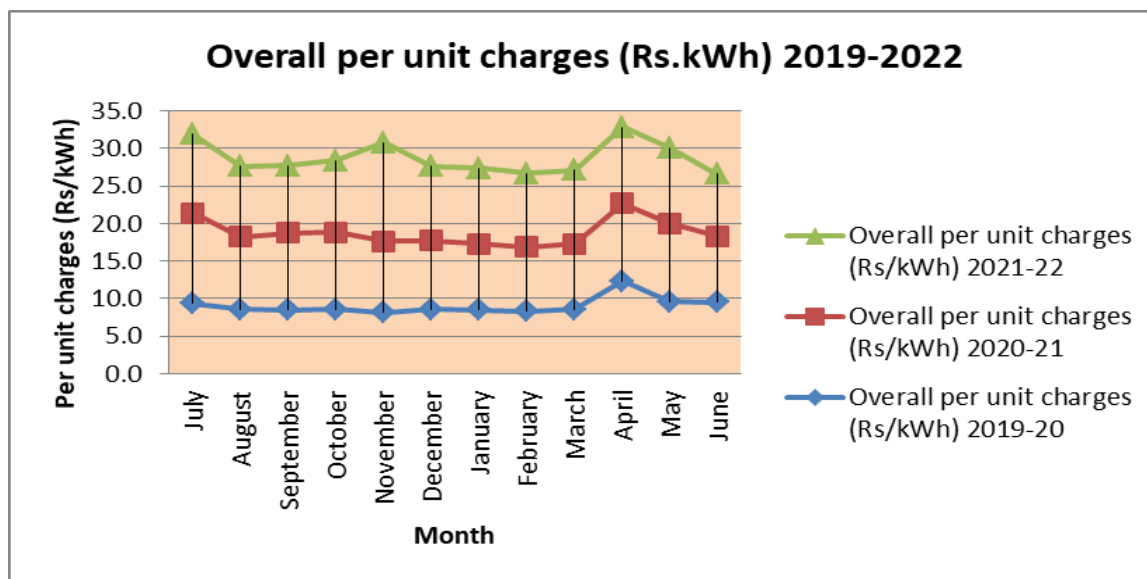


Figure 3.4.3:- Graphical presentation of actual per-unit charges for years 2019-2022

Observation:

- ✚ Overall per unit charges Rs/kWh is Rs 9.0 in Year-2019-20
- ✚ Overall per unit charges Rs/kWh is Rs 9.7 in Year-2020-21
- ✚ Overall per unit charges Rs/kWh is Rs 10 in Year-2021-22



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3.5 ON Site power measurement in university on dated 07-12-2022.

Table 3.5 Operating load measurement on various buildings.

Sr. No.	Location	Voltage (V)	Current (A)	PF	Input power (KW)
1	Chemistry dept.	409	1.8	0.86	1.10
2	Incubation center	398	11.2	0.88	6.79
3	High tech green house	397	6.8	0.87	4.07
4	Central library	396	7.2	0.86	4.25
5	Alongbar science building	399	9.3	0.86	5.53
6	Dept.of biotechnology	398	4.7	0.88	2.85
7	Dept.of Mathamatical science	397	1.1	0.88	0.67
8	Arts building	399	6.5	0.87	3.91
9	Suniti kr. Chatterjee hall	397	6.5	0.89	3.98
10	Dept. of zoology	399	6.8	0.86	4.04
11	Br. Ambedkar social science building	401	6.6	0.87	3.99
12	1st Floor	399	5.5	0.87	3.31
13	Admin building	396	21.8	0.88	13.16
14	SC girls hostel	398	4.2	0.89	2.58
15	ST girls hostel	399	2.1	0.87	1.26
16	Genral girls hostel	401	2.8	0.87	1.69
17	New girls hostel	416	10.2	0.86	6.32
18	Boys hostel	403	1.8	0.87	1.09
Total Operating Load KW					70.57



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Table 3.6:-Total connected load of the university

Admin building ground floor									
Sr. No.	Location	Fan	Tube light (40W)	LED Light (18Watt)	Wall fan	AC	Bulb	Exhaust	CFL
1	Examination Branch	3	2	0	4	0	0	0	0
2	B.ED, M.ED Section	1	2	0	4	0	0	0	0
3	Deputy Registrar	1	2	0	1	0	0	0	0
4	Deputy Registrar washroom	0	0	0	0	0	1	1	0
5	Outside registrar office	0	0	0	0	0	1	0	0
6	B.ED, M.ED Section	1	2	0	1	0	0	0	0
7	Controller of Exam	4	6	0	0	2	0	0	0
8	Controller of Exam washroom	0	0	0	0	0	0	1	0
9	PG & Above Section	2	3	0	3	0	0	0	0
10	Server room	2	2	0	0	2	0	0	0
11	Student welfare CUDC branch	2	3	0	0	0	0	0	0
12	DSW General branch	2	2	0	0	0	0	0	0
13	Director of student welfare	2	3	0	0	1	0	0	0
14	CUDC	2	4	0	0	0	0	0	0
15	CUDC Washroom	0	0	0	0	0	1	1	0
16	Junior Engineer Section	4	5	0	0	0	1	0	0
17	Civil Engineer	2	2	1	1	0	0	0	0
18	Account Washroom	0	0	0	0	0	1	1	0
19	Junior Engineer Civil	2	3	0	0	0	0	0	0
20	Toilet	0	0	4	0	0	1	2	0
21	Finance Officer	1	2	0	0	0	3	0	0
22	Deputy Registrar	4	2	4	0	1	1	1	0
23	Corridor	0	0	0	0	0	15	0	16
	Total	35	45	9	14	6	25	7	16



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Admin building ground floor								
Sr.No	Location	Fan	Tube light (40W)	LED Light (18Watt)	LED Bulb	Wall fan	AC	CFL
1	PA vice chancellor	1	1	0	0	0	1	0
2	conference room	4	8	0	0	0	3	0
3	Toilet	0	8	1	0	0	0	0
4	Pantry	0	0	0	0	1	0	1
5	Confrencehalkl	6	23	0	0	2	4	0
6	PS Registrar	2	2	0	0	0	0	0
7	Registrar	3	17	0	0	3	2	0
8	Joint registrar	3	10	0	0	0	1	0
9	Established branch	2	2	0	0	0	1	0
10	Provisional Certificate branch	2	2	0	0	0	0	0
11	Registrar branch	3	4	0	0	0	0	0
12	Academic branch	2	3	0	0	0	0	0
13	Law officer	4	1	3	0	0	1	0
14	Academic branch	2	3	0	0	0	0	0
15	Academic branch	2	3	0	0	0	1	0
16	Rector	2	3	0	0	0	1	0
17	Corridor	0	0	0	11	3	0	22
18	VC Sir room	6	16	0	0	0	3	3
	Total	44	106	4	11	9	18	26



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Ground floor (Chemistry dept.)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Chemistry Lecture Hall	3	12	0	0	0	0	231, 239, 244
2	Research Lab 1	2	5	0	0	0	0	211, 234, 239
3	Research Lab 2	2	5	0	0	0	0	232, 267, 278
4	Chemistry Lab 1	4	13	0	0	0	0	201, 230, 275
5	Chemistry Lab 2	6	15	0	0	0	0	213, 254, 239
6	Conference Hall	4	9	0	0	0	0	236, 238, 266
	Total	21	59	0	0	0	0	

First Floor (Physics Dept.)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Physics Lecture Hall 1	5	5	0	0	6	0	232, 243, 248
2	General Lab	3	6	0	0	3	0	243, 254, 268
3	Physics Lecture Hall 2	2	4	0	0	2	0	256, 268, 238
4	Optics Lab	2	3	0	0	0	1	211, 263, 250
5	CMP Lab	2	0	0	0	2	0	233, 247, 265
6	Nuclear Physics	3	0	0	0	2	0	231, 249, 253
7	Nano Project Lab	2	1	3	0	0	1	233, 239, 242
8	Prof. Room	2	2	1	0	1	0	248, 262, 275
9	Prof. Room	2	1	2	0	2	0	263, 230, 247
	Corridor	2	10	0	7	0	0	209, 218, 224
	Total	25	32	6	7	18	2	

Incubation center								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	High Tech. Tissue Lab	0	0	12	0	0	4	235, 265, 278
2	Central Lab	8	0	8	0	0	3	281, 270, 263
3	Rooms	8	0	25	0	0	0	261, 269, 274
	Total	16	0	45	0	0	7	



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Library building								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Library	25	12	36	27	2	0	235, 281, 269
2	First Floor	41	81	0	0	0	1	218, 249, 277
3	Second Floor	33	69	0	0	0	0	276, 283, 248
	Total	99	162	36	27	2	1	

Alongbar Science Building

Ground Floor (Computer Science Dept.)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED	Wall Fan	AC	Lux Level
1	Server Room	1	1	0	0	0	1	201, 212, 231
2	Computer Science Lab	0	0	0	30	0	2	233, 241, 253
3	Room	2	4	0	0	0	0	240, 257, 266
4	Computer Center	2	4	0	0	0	0	238, 254, 271
5	Room	2	4	0	0	0	0	243, 265, 270
6	Room	2	4	0	0	0	0	213, 274, 253
7	Class Room 1	2	4	0	0	0	0	231, 250, 264
8	Class Room 2	0	2	0	0	0	0	231, 276, 255
9	Conference Room	2	3	0	0	0	0	234, 268, 279
10	Class Room 3	5	6	0	0	0	0	245, 264, 254
11	Class Room 4	2	3	0	0	0	0	234, 239, 244
	Total	20	35	0	30	0	3	



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First floor (Dept. of Biotechnology)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Room	1	1	0	0	0	0	210, 218, 223
2	Lab 1	4	0	5	0	0	0	234, 276, 256
3	Lab 2	3	2	0	0	0	1	243, 251, 249
4	Lab	2	3	0	0	0	0	230, 256, 265
5	Room	2	3	0	0	0	0	235, 255, 265
6	Room	2	1	0	0	0	0	204, 213, 217
7	Reading Room	1	2	0	0	0	0	231,238, 245
8	Office	2	3	0	0	0	0	254, 276,235
9	Class Room	2	3	0	0	0	0	238, 267, 277
10	Conference Hall	6	5	0	0	0	0	282, 276, 269
11	Biotech Hub	2	6	2	0	3	0	231, 238, 243
	Total	27	29	7	0	3	1	
Second floor (Dept. of Mathematical science)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	A C	Lux Level
1	Bamboo Technology	4	6	0	0	0	0	234, 239, 250
2	Bamboo Studies	1	2	0	0	0	0	231, 238, 245
3	Class Room 1	8	12	0	0	0	0	245, 255, 269
4	Class Room 2	8	12	0	0	0	0	276, 265, 258
5	Room	2	3	3	0	0	0	264, 258, 277
6	HOD Room	2	4	1	0	0	0	277, 289, 281
7	Room	4	3	3	0	0	0	265, 261, 240
8	Room	8	12	0	0	0	0	213, 248, 267
9	Room	3	3	3	0	0	0	266, 278, 283
	Total	40	57	10	0	0	0	



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Third floor (Dept. of management studies)

Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Room 1	2	4	0	0	0	0	240, 257, 266
2	Room 2	2	4	0	0	0	0	238, 254, 271
3	Room 3	2	2	0	0	0	0	243, 265, 270
4	Room 4	1	2	0	0	0	0	213, 274, 253
5	Room 5	1	2	0	0	0	0	231, 250, 264
6	Room 6	1	2	0	0	0	0	231, 276, 255
7	Room 7	1	2	0	0	0	0	214, 233, 240
8	Room 8	1	2	0	0	0	0	243, 225, 208
9	Room 9	1	2	0	0	0	0	276, 265, 258
10	Room 10	1	2	0	0	0	0	264, 258, 277
11	Room 11	2	4	0	0	0	0	277, 289, 281
12	Class Room 1	2	4	0	0	0	0	211, 234, 239
13	Hall	8	12	0	0	0	0	232, 267, 278
14	Room	8	10	2	0	0	0	201, 230, 275
15	Room	8	5	5	0	0	0	232, 245, 288
16	Corridor	0	15	5	0	0	0	238, 245, 259
	Total	41	74	12	0	0	0	

New arts building

Ground floor (Dept. of Geography)

Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Room	1	0	1	0	0	0	232, 239, 242
2	GIS Lab	2	0	1	0	0	0	256, 267, 276
3	Class Room 1	1	0	1	0	0	0	243, 280, 254
4	HOD	2	0	3	0	0	0	241, 265, 278
5	Class Room 2	2	0	2	1	0	0	213, 238, 265
6	Cartography Lab	4	0	2	0	0	0	237, 256, 277
7	Room	1	0	1	1	0	0	219, 270, 218
8	Class Room	4	0	2	0	0	0	219, 222, 235
	Total	17	0	13	2	0	0	



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Ground floor (Education dept.)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Class Room	4	0	2	0	0	0	232, 245, 249
2	Room	5	0	2	4	0	0	238, 267, 289
3	Class Room	7	0	2	0	0	0	235, 250, 240
4	Room	1	0	2	2	0	0	254, 233, 276
5	Office	1	0	2	2	2	0	212, 229, 225
6	HOD	0	0	2	0	2	0	274, 266, 260
	Total	18	0	12	8	4	0	
First floor (Commerce Dept.)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Hall 1	6	0	2	1	0	0	231, 276, 255
2	Hall 2	4	0	2	0	0	0	214, 233, 240
3	Hall 3	2	0	4	0	0	0	243, 249, 256
5	Hall 5	11	0	4	0	0	0	264, 258, 277
6	Room 1	4	0	2	0	0	0	277, 289, 281
7	Room 2	1	0	1	1	0	0	265, 261, 240
8	Room 3	1	0	2	2	0	0	213, 248, 267
9	Room 4	1	0	1	1	0	0	243, 265, 270
10	Room 5	1	0	2	0	0	0	213, 274, 253
	Corridor	20	0	20	0	0	0	238, 259, 260
	Total	51	0	40	5	0	0	



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Suniti Kr. Chattarjee Hall								
Ground floor (Bodo Study Center)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Seminar Hall	8	9	1	0	0	0	239, 248, 267
2	Center of Bodo Studies	8	9	1	0	0	0	230, 222, 256
3	Room	8	3	0	1	0	0	231, 239, 245
4	Conference Hall	3	6	0	0	0	1	233, 240, 248
5	Library	4	6	0	0	0	0	248, 264, 267
6	Room	8	6	4	0	0	0	238, 277, 260
7	Common Room	1	2	0	0	0	1	244, 249, 256
	Total	40	41	6	1	0	2	
First Floor (Bodo Dept.)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Class Room	8	8	0	0	0	0	283, 277, 267
2	Class Room	8	8	0	0	0	0	280, 276, 265
3	HOD Room	2	2	0	0	0	1	237, 264, 255
4	Language Lab	4	4	0	0	0	0	238, 230, 276
5	Room	4	4	1	1	0	1	235, 266, 250
6	Director Room	4	3	1	0	0	2	213, 246, 278
7	Room	4	4	0	0	0	0	232, 254, 277
8	Office	1	2	0	0	0	0	289, 267, 213
	Total	35	35	2	1	0	4	
Second Floor (Bodo Dept.)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Class Room	8	0	2	0	0	0	233, 248, 255
2	Class Room	8	0	2	0	0	0	239, 276, 288
3	Room	1	0	0	2	0	0	287, 256, 270
4	Room	2	0	0	3	0	0	270, 244, 256
5	Room	2	0	0	4	0	0	267, 289, 265
6	Room	2	0	0	2	0	0	255, 242, 290
7	Library	2	0	0	2	0	0	253, 254, 239
8	Common Room	1	0	0	1	0	0	230, 246, 237
	Total	26	0	4	14	0	0	



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Third Floor								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Rooms	42	0	33	0	0	0	239, 254, 268
2	Corridor	18	20	0	4	0	0	233, 239, 245
	Total	60	20	33	4	0	0	

Dept. of Micro Biology								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Lab	9	3	0	4	0	0	230, 240, 259
		9	3	0	4	0	0	

Dept. of Zoology								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Fish & Fishery	3	1	0	1	0	0	239, 267, 245
2	Fish & Fishery Lab	3	1	1	1	0	0	290, 256, 269
3	Class Room	6	2	0	4	0	0	231, 237, 242
4	Lab	2	1	2	1	0	0	230, 212, 255
5	Room	6	3	1	3	0	0	267, 262, 276
	Total	20	8	4	10	0	0	

Dept. of Botany								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Room	6	2	0	4	0	0	238, 267, 289
2	Lab	2	1	1	0	0	0	230, 254, 244
3	Room	3	1	0	2	0	0	233, 255, 269
4	Room	3	2	0	2	0	0	240, 243, 249
5	HOD	3	0	2	2	0	0	241, 239, 250
6	Class Room	6	4	0	0	0	0	234, 249, 245
	Total	23	10	3	10	0	0	

Auditorium								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Auditorium Hall	16	16	0	0	0	0	239, 233, 245
	Total	16	16	0	0	0	0	



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Br. Ambedkar Social Science Building								
Ground floor (History Dept.)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Office Room	3	2	0	0	0	0	238, 245, 230
2	Room	9	9	0	0	0	0	210, 237, 267
3	Class Room 3	6	6	0	0	0	0	213, 246, 278
4	Conference Hall	8	8	0	0	0	0	232, 254, 277
5	Class Room 2	6	6	0	0	0	0	289, 267, 213
6	Class Room 1	8	6	0	0	0	0	231, 239, 241
	Total	40	37	0	0	0	0	
First floor (Dept. of economics)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Library	4	3	0	0	0	1	238, 244, 256
2	Room	4	8	0	0	0	0	256, 211, 250
3	Room	3	3	0	0	0	0	233, 229, 254
4	Room	3	3	0	0	0	0	242, 258, 276
5	Room	3	3	0	0	0	0	273, 256, 241
6	Room	2	2	0	0	0	0	219, 227, 237
7	Class Room 1	10	6	0	0	0	0	245, 255, 269
8	Class Room 2	6	6	0	0	0	0	261, 252, 276
9	Class Room 3	9	8	0	0	0	0	286, 216, 259
10	Hall	4	6	0	0	0	0	278, 271, 284
	Total	48	48	0	0	0	1	



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Second floor (Dept. of political science)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Room	3	2	0	0	0	0	230, 218, 222
2	Room	2	2	0	0	0	0	254, 259, 270
3	Room	6	7	0	0	0	0	273, 219, 245
4	Room	4	6	0	0	0	0	255, 267, 270
5	Room	3	1	3	0	0	1	252, 233, 248
6	Class Room 1	8	6	0	0	0	0	271, 267, 260
7	Class Room 2	8	6	0	0	0	0	273, 256, 277
8	Class Room 3	4	6	0	0	0	0	286, 245, 234
9	Hall	11	6	0	0	0	0	233, 219, 227
10	Corridor	2	18	0	0	0	0	213, 230, 239
	Total	51	60	3	0	0	1	

Gurudev kalicharan brahma building								
Ground Floor (English Dept.)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Room	3	0	3	0	0	0	234, 243, 249
2	Room	4	5	0	0	0	0	245, 256, 260
3	Room	8	21	0	0	0	0	265, 271, 233
4	Room	8	12	0	0	0	0	212, 230, 254
5	Room	0	6	0	4	0	0	242, 238, 249
6	Class Room 1	4	6	0	0	0	0	241, 256, 278
7	Class Room 2	4	11	0	0	0	0	270, 265, 255
8	Class Room 3	4	6	0	0	0	0	243, 253, 233
9	Hall	11	24	0	0	0	0	240, 220, 235
10	Seminar Hall	9	16	0	0	0	0	287, 276, 263
11	Dept. Of English	7	22	0	0	0	4	271, 277, 282
12	HOD	4	8	2	0	0	0	212, 243, 265
	Total	66	137	5	4	0	4	



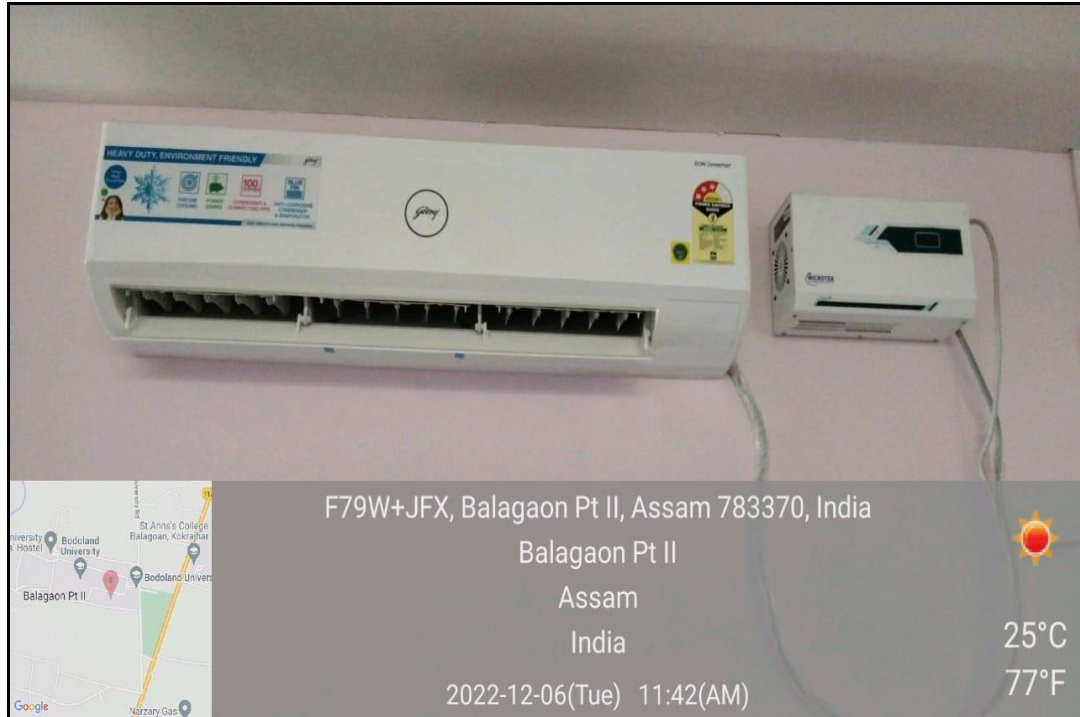
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First floor (Assamese Dept.)								
Sr. no.	Location	Fan	Tube Light (40 Watt)	LED Light (18 Watt)	LED Bulb	Wall Fan	AC	Lux Level
1	Room	2	4	0	0	0	0	213, 234, 222
2	Room	4	3	3	0	0	0	235, 256, 267
3	Room	4	4	3	0	0	0	265, 278, 271
4	Museum	3	6	7	0	0	0	268, 280, 277
5	Room	3	5	4	0	0	0	263, 253, 241
6	HOD	3	5	1	0	0	0	241, 248, 255
7	Room	8	20	1	0	0	0	244, 251, 256
8	Class Room 1	7	11	2	0	0	0	276, 271, 283
9	Class Room 2	9	12	3	0	0	0	222, 238, 265
10	Class Room 3	9	4	9	0	0	0	253, 237, 291
11	Lab	8	8	8	0	0	2	212, 230, 264
12	Room	3	5	2	1	0	0	237, 252, 230
13	Corridor	4	17	5	12	0	0	231, 223, 219
	Total	67	104	48	13	0	2	



Some Photographs of Electrical Equipment's



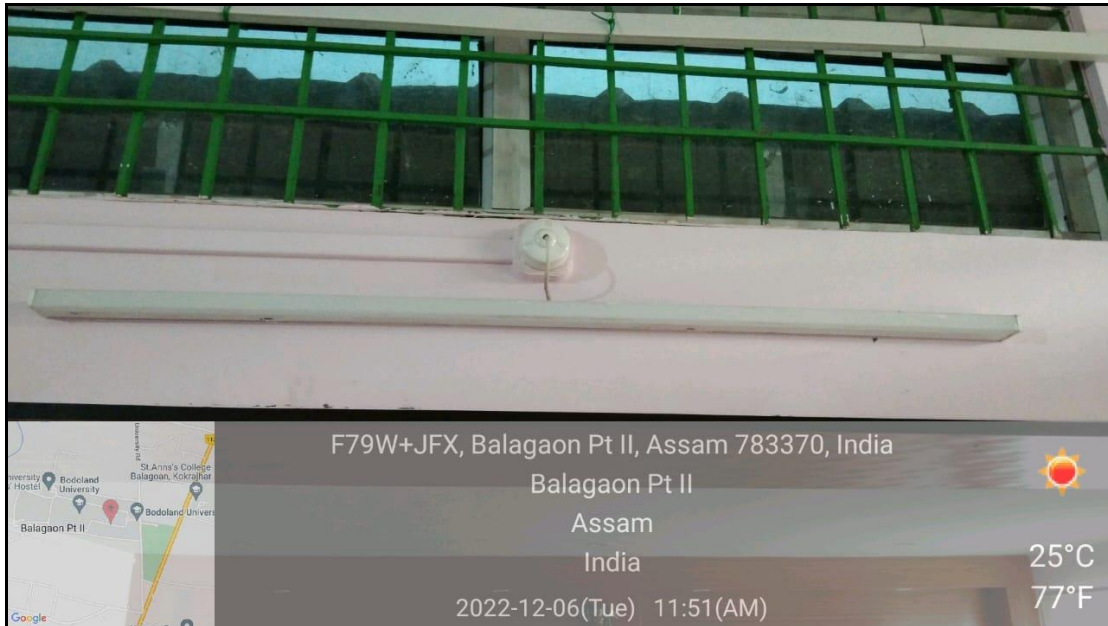
AC



Ceiling Fan



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Tube light



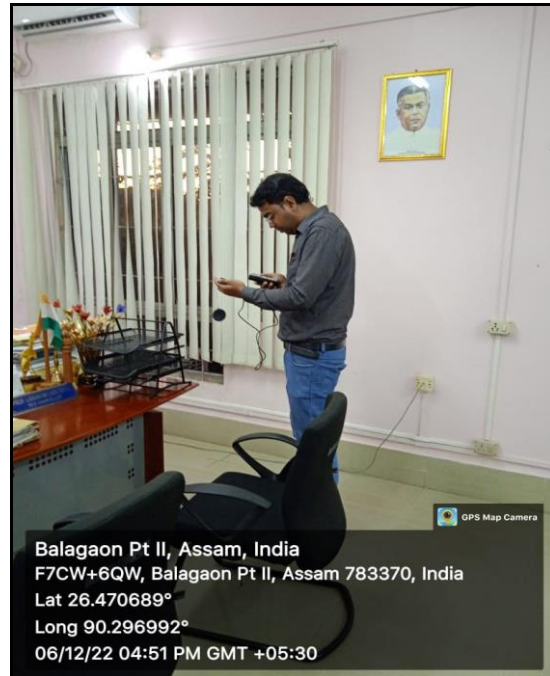
Water Cooler



Some photographs of power measurement and lux level.



Power Measurement on Transformer



Lux measurement in university



**CHAPTER- 4
ENERGY CONSERVATION MEASURES**

Case Study No. -01

Installation 90 kWp solar roof top grid connected system

Observation: -

It is observed that there is good potential for installation of solar roof top grid connected system

Recommendation:

Installation 90 kWp solar photovoltaic roof top grid connected system.

Solar unit (Energy) generation calculation: -

Case Study: Solar unit (Energy) Generation calculation: -			Unit
1	Theoretical capacity calculation of solar plant on Transformer Capacity		
2	New Transformer Capacity	250	KVA
3	Maximum theoretical limit as per Net Metering policy of Electricity board	45	%
4	Maximum theoretical Potential limit of solar plant as per the transformer capacity	112.5	KVA
5	Power Factor of the Electrical System	0.8	
6	Theoretical solar plant capacity as per transformer Capacity	90	KWp
7	Expected Solar Unit generation @4 unit/day/KWp	360	kWh/Day
8	Expected Annual Solar Unit generation of their Solar Plant	1,31,400	KWh/Year
9	Annual Unit consumption of university (Year 2021-22)	2,64,546	kWh/Year
<p>Analysis: As per the theoretical calculation of solar plant capacity based on transformer rated capacity is 250 KVA and expected annual unit generation of solar plant is 1, 31,400 units w.r.t annual energy consumption of the university is 264546 units. It is justify recommended the solar plant capacity 90 kwp is accepted.</p>			
Payback Period Calculation			
1	Total solar unit generation of the system(90 kwp)	1,31,400	kWh/year
2	Overall Energy Charges per Unit as per Electricity bill	7.2	Rs./kWh
3	Expected revenue generation	9,46,080	Rs./year
4	Expected cost of 1kw solar plant @50Rs.perwatt	50,000	Rs./KWp
5	Expected total investment	45,00,000	Rs.
6	Simple payback period of the project	4.8	year

Note: - Energy generation depends on sunshine over per day and load factor of the systems.



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Case Study No. -02

Replacement of conventional 40 Watt tube light by energy-efficient LED tube light 18 watt in phase manner.

Replacing (40 W) Tube lights with Energy efficient (18 W LED) lights			
Calculation on Existing system			
1	Total (40W) Tube	No.	1118
2	Rated Power	Watt	40
3	Operating Hrs.	Hrs./day	8
4	Operating Annual Days	Days/Year	250
5	Unit Consumed Annually	kWh/Year	89440
Calculated saving after tube replacement			
1	Replacement with 18 W LED tube Light	Watt/unit	18
2	Unit Consumed Annually after replacement	kWh/Year	40,248
3	Total Annually Energy Saving after replacement	kWh/Year	49,192
4	Total Annual Energy Cost Saving @ Rs. 7.20 per unit	INR	3,54,182/-
Estimated Investment cost calculation			
1	Capital Cost Rs. 200 per tube light	INR	2,23,600
2	Maintenance Investment @ 5%	INR	11,180
3	Total investment Rs	INR	2,34,780
4	Simple payback (Investment/annual savings)	Month	7.95

Total calculated monetary saving potential in lighting = Rs 3, 54,182 /-

Note: - Energy savings depend on the operation hour per day and the load factor of the systems.



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Case Study No. -03

Replacement of conventional 18 Watt CFL by energy-efficient LED bulb 09 Watt in phase manner

Replacing (18 W) CFL with Energy efficient (09 W LED) bulb			
Calculation on Existing system			
1	Total (18 W) Tube	No.	42
2	Rated Power	Watt	18
3	Operating Hrs.	Hrs./day	8
4	Operating Annual Days	Days/Year	250
5	Unit Consumed Annually	kWh/Year	1512
Calculated Saving after tube replacement			
1	Replacement with 09 W LED bulb	Watt/unit	9
2	Unit Consumed Annually after replacement	kWh/Year	756
3	Unit Saving after CFL replacement	kWh/Year	756
4	Total Annual Energy Cost Saving @ Rs. 7.20 per unit	INR	5443.2
Estimated Investment cost calculation			
1	Capital Cost Rs.100 per tube light	INR	4200
2	Maintenance Investment @ 5%	INR	210
3	Total investment	INR	4,410
4	Simple payback (Investment/annual savings)	Month	9.7

Total Calculated Monetary Saving Potential in lighting = Rs 5,543/-

Note: - Energy saves depends on the operation hour per day and the load factor of the systems.



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Case Study No. 4

Replacement of 80 W conventional ceiling fan by 28W BLDC Energy Efficient ceiling fan in Phase manner

Replacing (80W) Ceiling Fan with Energy efficient BLDC Fan (28 W)			
Calculated on existing system			
1	Ceiling Fan (80 W)	No.	955
2	Rated Power	Watt	80
3	Operating Hrs.	Hrs./day	8
4	Operating Annual Days	Days/Year	200
5	Unit Consumed Annually	kWh/Year	1,22,240
Calculated Saving after replacement			
1	Replacement with 28 W BLDC Fan	Watt/unit	28
2	Unit Consumed Annually after replacement	kWh/Year	42,784
3	Annually unit Saving after replacement	kWh/Year	79,456
4	Total Annual Energy Cost Saving @ Rs.7.20 per unit	INR	3,08,044
Estimated Investment cost calculation			
1	Capital Cost (Rs.2000/- per Fan)	INR	19,10,000
2	Maintenance investment @ 5 %	INR	95,500
3	Total investment	INR	20,05,500
4	Simple payback (Investment/annual savings)	Year	6.51

Total Calculated Monetary Saving Potential in Ceiling Fan = Rs 3, 08,044/-

Note: - Energy savings depend on the operation hour per day and the load factor of the systems.



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END OF THE REPORT

THANKS